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ENGINEERING AND

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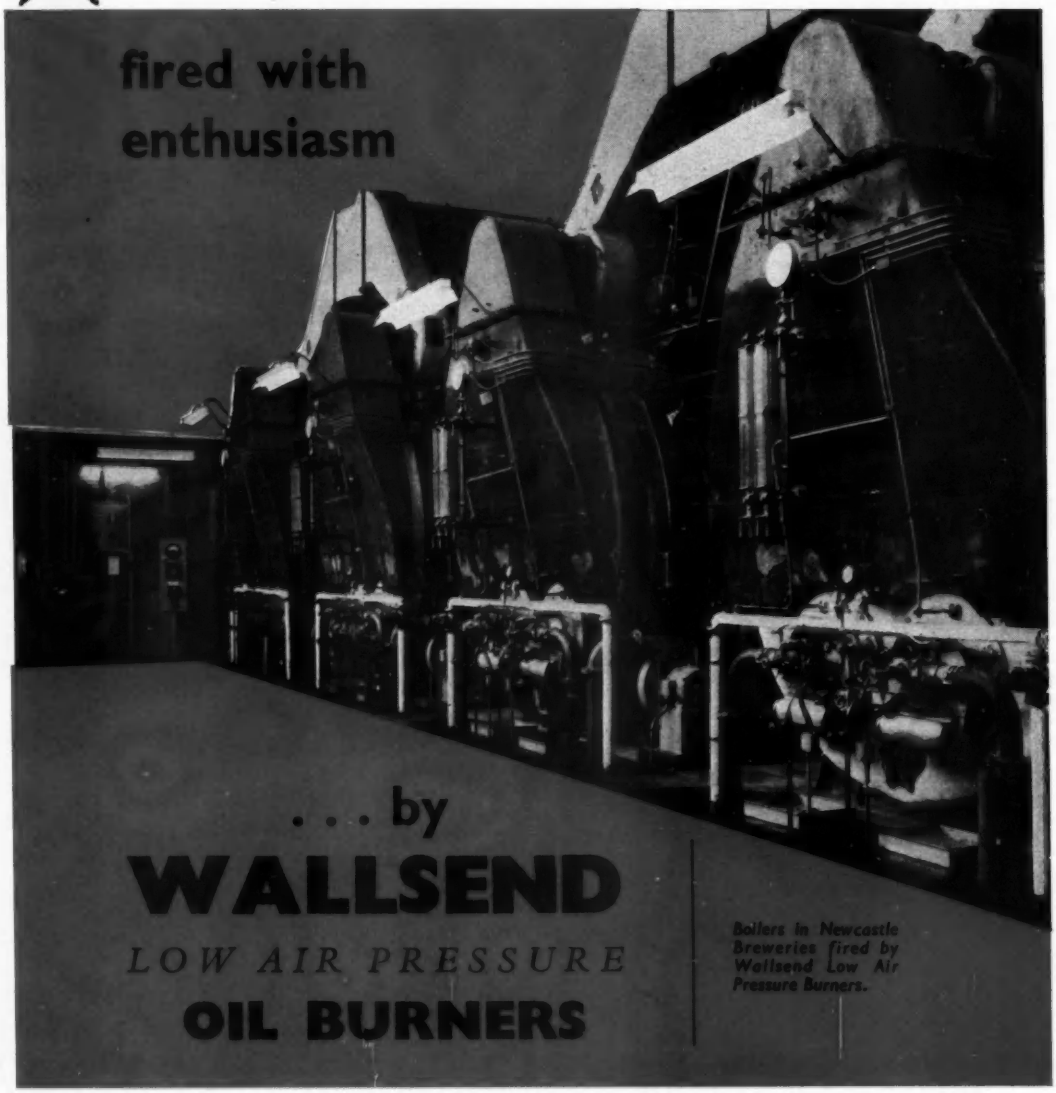

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Engineering and BOILER HOUSE REVIEW

THE OLDEST ESTABLISHED STEAM ENGINEERING PUBLICATION

AUGUST 1961

VOLUME 76. No. 8

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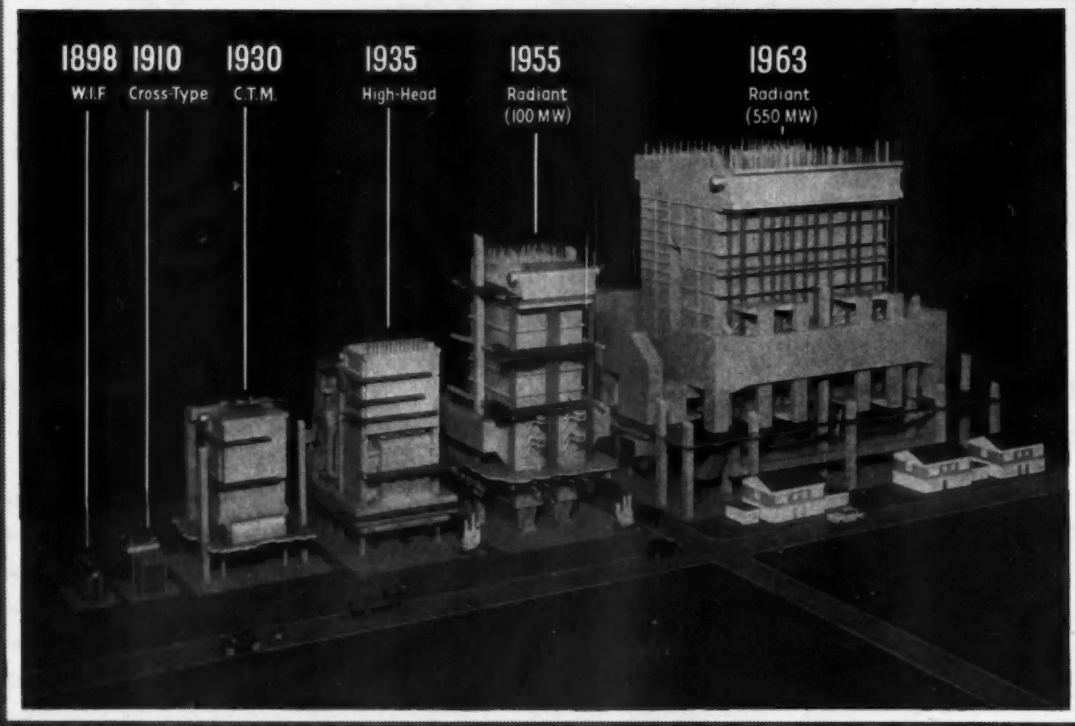
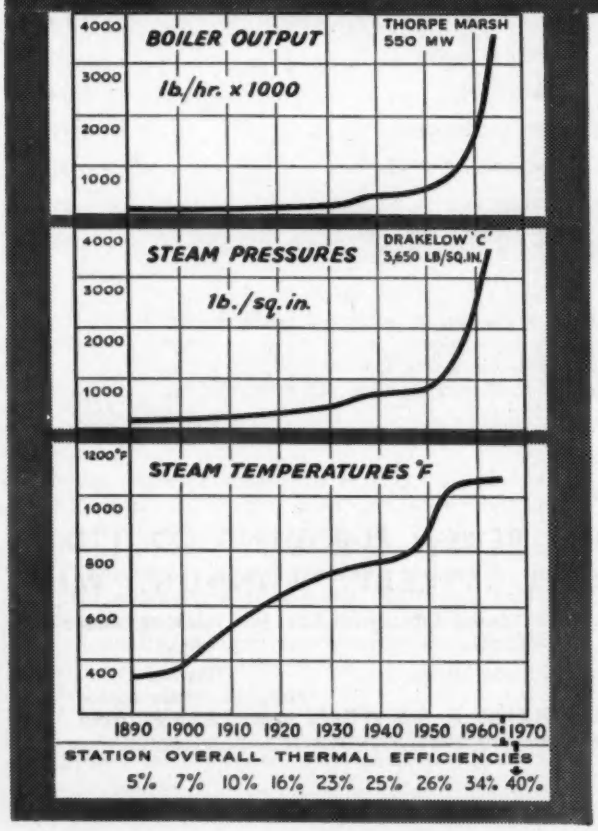
THE MARCH OF STEAM





Progress in power generation, to the present stage of a single boiler to serve a 550 MW set or to operate at supercritical pressure, with central-station thermal efficiencies of the order of 40%, has followed the path of advancing steam technology and engineering, an advance in which, for well over half a century, the BABCOCK organization has been in the lead.

The illustrations show the development of central-station boiler units, in size, type and steam conditions over a period of some 70 years. The steep rise over the last decade reveals design and manufacturing capabilities that are keeping British boiler engineering in the forefront of world development. 98% of Britain's, and 80% of the world's electrical power is steam generated – a high proportion of it using BABCOCK boiler plant.

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STEEL CREEP RESEARCH AT E.R.A.

SINCE the early 1920s, the operating steam temperatures of electrical power generating plant have been increased by about 50 per cent., while steam pressures have risen to about four times what they were. In other words, the figures of 40 years ago—600 lb. per sq. in., and 680 deg. F.—have risen to 2,400 lb. per sq. in. and 1,055 deg. F. at recent stations such as High Marnham and Blyth "B." The more recently-projected "super-critical" stations will operate at 3,650 lb. per sq. in. and 1,110 deg. F.

The result of these and other technological advances has been to raise the overall efficiencies of power stations from something less than 20 per cent. to about 34 per cent. This improvement has only been possible as the result of research on the high temperature properties of the generating plant. But although considerable economic gains accrue from such increases in efficiency, the higher pressures and temperatures dictate the use of expensive high-quality steels in large quantities in the construction of the major items of plant such as boilers, turbines and pipework. This, in turn, calls for constant development activity on the part of the steel-makers, and research on the part of the users, in order to ensure that a reasonable balance can always be achieved between the durability and cost of the power plant equipment. When a new steel has been developed with promising high temperature properties, the plant and equipment designer must have a knowledge of its creep and rupture qualities before he can achieve the optimum compromise between economy of material usage and durability of structure. Such information can only be gained through exhaustive laboratory investigations.

The Electrical Research Association, which has been actively engaged in this type of research for nearly 30 years, opened on July 6th, a new laboratory for this purpose. The new "Creep of Steel Laboratory," which has been built during the past year on the E.R.A. site at Leatherhead, was formally opened by Dr. Charles Sykes, C.B.E., F.R.S. It has a floor area of 9,900 sq. ft. and appears to be one of the best equipped facilities of its kind in Great Britain. There are 50 high-sensitivity creep machines which make use of accurate optical techniques to measure the creep properties of rotor forgings, while another 25 machines are equipped with dial gauge extensometers for measuring creep on the thick castings used for turbine casings. A 15-ton creep machine is also available for testing specimens that have been taken from the full wall thickness of steam-pipes. The rupture characteristics of high-temperature steels used for the manufacture of steam-piping and superheater tubes are measured in multi-rupture testing machines, in which either ten or three specimens, depending upon the size of the furnace, are stressed in series, and the time taken to fracture each specimen is measured. Such testing machines are new to this country, and make stringent demands on the temperature control equipment.

Temperature control of the specimens for creep and rupture testing is achieved by electronic temperature controllers actuated by platinum resistance thermometers inserted in the furnaces. The temperature of each furnace is measured by either three or five thermocouples tied to the specimens, with leads that are then taken off to a central control room. At the control desk in this room, a thermocouple-bridge reading can be taken of the temperature of any specimens currently being tested in the laboratory. From the measurements of the time taken to reach a specific amount of creep, or to rupture with variable stress or temperature, graphs are plotted so that estimates may be made of the expected life of components used in power plant and associated equipment. This satisfies the immediate aims of the laboratory, i.e., to furnish designers with the necessary data for a given project. Another major item of research in this laboratory is the correlation of the high-temperature stress rupture properties obtained by uniaxial tensile tests with those obtained by subjecting thick-walled tubes to internal steam pressure. The results are then compared with predicted values obtained from three simple design formulae.

The cost of building the new laboratory has been borne by the Central Electricity Generating Board; The Water-Tube Boilmakers' Association; The British Iron & Steel Research Association; some of the leading turbine manufacturers, and three of the leading firms of piping manufacturers.

Points and Pointers

HOLME PIERREPONT APPLICATION REFUSED

In the House of Commons recently, the Minister of Power, the Rt. Hon. Richard Wood, M.P., said that he had decided not to consent to the application by the Central Electricity Generating Board to construct a power station at Holme Pierrepont. Mr. Wood said that more power stations on economic sites were urgently needed, but inspectors he had appointed to hold a public enquiry advised him that a station at Holme Pierrepont would seriously reduce the extent of an area of open country of particular amenity value, comparatively near to the city of Nottingham, and that the necessary movement of the supply of coal by rail to the station would in all probability intensify the city's rail traffic problems. The application of the C.E.G.B. for the Minister's consent to the construction of a 2,000-MW station at Pierrepont was the subject of a public enquiry held by the Chief Engineering Inspector of the Ministry of Power, and a senior inspector of the Ministry of Housing and Local Government, during November/December, 1960, and January, 1961. The proposal was opposed by the Nottingham County Council, the other local authorities in the area, and a considerable number of other organisations and individuals.

THE BEAMA GOLDEN JUBILEE EXPORT CONFERENCE

The emphasis placed by electrical manufacturers on increasing their exports, is reflected in the programme arranged by the British Electrical and Allied Manufacturers' Association for the BEAMA Golden Jubilee Export Conference which is being arranged to be held at the Connaught Rooms, London, on October 5th and 6th next. The President of the Board of Trade will speak at the Conference luncheon, and on the first day there will be papers by leading authorities, followed by discussions on electrical engineering and problems of trading in electrical plant and equipment with Europe and the Western Hemisphere. The session on the second day is reserved for a series of discussion groups, some five in number, on subjects of vital importance to all exporters. Each group will have a chairman who is a member of the BEAMA Export Panel, and two discussion leaders. Subjects covered by the discussion groups will be;—finance for export; market research; standards and practice and designs for foreign markets; the changing pattern of overseas trade; export publicity, advertising and fairs. The Conference Chairman will be Mr. Leonard Short, M.C., Chairman Designate of the BEAMA Export Panel, and Director of Overseas Operations of the English Electric Co. Ltd. The respective titles of the papers, and their authors will be: "The Electrical and Allied Industry in the Export Field" by A. M. Browne, President of BEAMA; "Engineering Achievements in the Electrical Industry," by F. H. S. Brown, C.B.E., Deputy Chairman C.E.G.B. (this paper will deal with development in this country and its effect on our export trade); "Exporting to Europe," by Sir William McFadzean, Chairman, Export Council for Europe; "Exporting to the Western Hemisphere," by W. J. M. Longmore, a Managing Director, Balfour, Williamson & Co. Ltd., Director, Bank of London and South America Limited, Member of the Western Hemisphere Exports Council.

THE NEW PRESIDENT OF THE MECHANICALS

At the annual meeting of the Institution of Mechanical Engineers, held some weeks ago, it was announced that Sir Kenneth Hague has been elected to succeed Professor Owen A. Saunders as President for the ensuing year. Sir Kenneth Hague was educated at New College School, Oxford, and at Leeds University. He joined Babcock & Wilcox Limited in 1924 and subsequently held various positions in the engineering and sales departments, ultimately becoming manager of the company's New York office, and their representative in the U.S.A. He was appointed a Director in 1940, Deputy Managing Director in 1942, Managing Director in 1945, Deputy Chairman and Managing Director in 1950, and Chairman in 1960. Sir Kenneth has been closely associated with the development of steam generating plant for major power installations through the last quarter of a century, and also with the nuclear power plants now under construction, in which his company has been one of the pioneers. He has interested himself in industrial labour relationships over many years. In 1941 he was a member of the U.K. Management/Labour delegation to the U.S.A., and in 1944 he was appointed the British representative on the Public Utilities Committee of the Combined Production and Resources Board in Washington. In the same year, he became a member of the Heavy Electrical Plant Consultative Council. From 1947 to 1952 he served as a member of the Engineering Advisory Council. He was Vice-President of the Engineering and Allied Employers' National Federation from 1955 to 1958, before being elected President of that organisation in which capacity he served it from 1958 to 1960. Sir Kenneth is a Past-President of the British Engineers' Association (1948-1950). He was Deputy Chairman of the Royal Ordnance Factories Board from 1953 to 1959, and was appointed a part-time member of the Iron and Steel Board in 1959. He received his knighthood in 1953. The new President is very widely travelled; the international responsibilities of Babcock & Wilcox Limited have taken him to almost every country in the world, and it is still necessary for him to travel abroad frequently. He is a Director of Power Securities Corporation Limited, and of other companies. Sir Kenneth became a full Member of the Institution in 1942. He has been a Member of the Council since 1947, and was appointed a Vice-President in 1956. After a short break, occasioned by his Presidency of the Engineering and Allied Employers' National Federation, he was re-appointed Vice-President in 1960. During the years of his first Vice-Presidency, he served the Institution on a

number of committees including the General Purposes, The Finance and House, and the Watt Medal Committees. More recently, he has been Chairman of the General Purposes Committee, and a member of several other Standing Committees of the Institution.

S.I.M.A. AND THE MOSCOW EXHIBITION

The Council of the Scientific Instrument Manufacturers' Association of Great Britain (20, Queen Anne Street, W.1) states that its 19 members who took part in the combined stand at the recent British Trade Fair at Moscow are very well pleased with the results. Firm contracts have been signed for 75 per cent. of the quarter of a million pounds worth of their exhibits. Preliminary contracts for a considerable additional quantity of equipment to be exported immediately, or in the near future, have also been placed. Although the Russian trading organisations were very busy, hard pressed, and drove hard bargains, they were also most co-operative, and displayed a friendly spirit which was much appreciated by the S.I.M.A. members. This is considered to be a reflection of the good relations which were established at S.I.M.A.'s 1960 exhibition in Moscow. Further suggestions have been received about the ways of increasing the liaison between these Russian organisations and S.I.M.A. The latter hope that their Russian trade will increase even further as the result of this, in the future. It is reported that the trade of S.I.M.A. members in scientific instruments has already doubled in each successive year since the first liaison was established in 1959.

NEWCOMEN SOCIETY INCORPORATED

The Newcomen Society, which was founded in 1920, has now been incorporated, by licence of the Board of Trade, under its existing title, "The Newcomen Society for the Study of the History of Engineering and Technology". All members of the unincorporated body will become members of the incorporated Society upon signing and returning forms of agreement which have been sent to them. The rights and privileges of members are not affected by the change, but the liability of members, formerly unlimited, is now limited to a maximum contingent contribution of £1 in the somewhat unlikely event of the Society being wound up with a financial deficit. The new class of member, the affiliated non-statutory member, has been formed consisting of libraries and institutions belonging to the unincorporated Society. These affiliated non-statutory members have all the rights and privileges of members, except those of receiving notice of, and voting at a general meeting of the Society. Incorporation will simplify the administration of the Society, and place it in line with the majority of other learned bodies and institutions. In its incorporated capacity, the Society is able to hold property and is eligible to receive bequests and gifts of land or other property.

YORKSHIRE POWER STATION PROPOSALS

The West Riding of Yorkshire County Council have approved the Central Electricity Generating Board's applications for permission to build two large coal-fired power stations on the River Aire, one at Eggborough some four miles east of Knottingley, and one adjacent to their existing station at Ferrybridge. The local authorities concerned, Selby and Osgoldcross at Eggborough, and Castleford and Knottingley at Ferrybridge, have also approved. The Generating Board now await the decision of the Minister of Power whose consent must be obtained. Each of the stations is planned to have a total installed capacity of 2,000-MW and will burn up to five million tons of coal a year. Most, if not all of this coal, would be drawn from the Yorkshire coalfield. The stations will thus provide a convenient and efficient method of using the quantities of small coals which are unsuitable for domestic use, but which are becoming increasingly available in the West Riding. With two chimneys each 650 ft. high, and eight cooling-towers, each station would be a conspicuous landmark. The Generating Board are conscious of this, and have agreed that the layout and architectural treatment, and also the landscaping of the sites, should be subject to the County Council's approval. The burning of such large quantities of the high ash product of the Yorkshire coalfield presents a major problem. When fully operating, each station would produce more than 100 tons of ash an hour. The Generating Board are therefore putting plans to the West Riding County Council concerning the disposal of ash.

INDEPENDENCE FOR COLLEGES OF ADVANCED TECHNOLOGY

In reply to a question in the House of Commons recently, Sir David Eccles, Minister of Education, said he was proposing to the local education authorities, that the control of the Colleges of Advanced Technology maintained by them should be transferred to independent governing bodies who would then receive direct grants from his department. In the five years since they were designated, these colleges have made remarkable progress, and the Government are now considering what further plans for expansion the colleges should be authorised to make, in order to allow them to allocate a greater number than the present total of 14,000 places. Under the Minister's proposal, new independent governing bodies would be established under trust deeds, and schemes of government drawn up for each college. The governing body would submit estimates to, and receive grants direct from, the Ministry, and would be fully responsible for the administration of the college. All staff at present in the service of the local education authority would be offered new contracts of service with the new governing body, and if the Minister's proposals are agreed, and the colleges become direct-grant establishments, Burnham scales need not apply. The Minister would propose to negotiate new salary scales, in consultation with the staffs and the governing bodies, which would be related to university salaries. The whole pattern of higher education is at present being reviewed by the committee of enquiry under the chairmanship of Lord Robbins. But it was made clear by the Minister of Education speaking in the House of Commons at the end of last year, that it was no part of the Government's intention to hold up urgent developments until the committee had completed their investigations and subsequently made their report. The proposal for a change of status is being made with the knowledge of the Robbins Committee and is not intended to prejudge any recommendations which that committee may make about the long-term future of the colleges.

Progress at Trawsfynydd

A RECENT visit to Trawsfynydd gave us the opportunity of seeing the good progress being made with the construction of the 500-MW nuclear generating station being built there for the Central Electricity Generating Board, by Atomic Power Constructions Limited. These notes deal primarily with the steam-raising plant and associated equipment, which is being manufactured and installed by International Combustion Limited.

Trawsfynydd, the fifth of the "commercial" nuclear power stations, has many points of interest. Siting, cooling-water supply, civil engineering work, fuel-handling, etc.—all have presented fresh problems for solution by the design teams of the member companies of Atomic Power Constructions Limited. Trawsfynydd, where work commenced in 1959, is the first of the commercial nuclear stations not situated in a coastal area. The site is, in fact, some 12 miles from Portmadoc, the nearest seaport, it is approximately 600 ft. above sea-level and, being located in the Snowdonia area (a national park), is subject to many additional restrictions from which the four previous nuclear stations have been free. The site is in Merionethshire, by Lake Trawsfynydd, an artificial reservoir, originally constructed for the Maentwrog hydro-electric scheme, and approximately three miles long and one mile wide.

The station will have an installed generating capacity of 580-MW, and a guaranteed output of 500-MW. Each of the two natural-uranium, graphite-moderated, gas-cooled reactors is contained in a spherical pressure-vessel, surrounded by a cylindrical biological shield, and is housed in its own separate reactor building. Reactor inlet and outlet temperatures will be 200 deg. C. and 399 deg. C. respectively, design max. fuel element temperature 440 deg. C., gas pressure at reactor inlet 240 lb./sq. in. g., and gas flow rate 9,000 lb./sec. The weight of uranium will be 280 tons, and the total weight of graphite 1,900 tons per reactor.

The spherical reactor pressure-vessels, which have an internal diam. of 61 ft., are made from 3½ in.-thick carbon manganese steel plate and designed for an operating pressure of 240 lb./sq. in. g. They are being manufactured by Babcock & Wilcox Limited under an agreement made in 1957 between A.P.C. Limited and Babcocks, whereby the latter will undertake detailed design, manufacture and erection of the reactor pressure-vessels in nuclear power stations to be constructed by A.P.C. Limited and their member companies.

The CO_2 main circulators (six per reactor) are of the single-stage axial-type, and are being supplied by Richardsons Westgarth & Co. Ltd. (one of the A.P.C. Associated Companies), and who are also supplying the four 145-MW main turbo-alternator sets. These circulators will be driven by constant-speed s/c induction motors—the blower power being 6,200 h.p., and the operating speed 2,950 r.p.m. The gas-blowers circulate the carbon-dioxide at a pressure of 240 lb./sq. in., to six boilers, three on each side of each reactor.

In addition to being responsible for the 12 boilers, complete with internal casings, tube elements, tube-bank supporting steelwork, integral pipework, headers, drums and external flooring and floor steelwork, International Combustion Limited are supplying the main gas-ducting between boilers and reactor vessels, including straight lengths 5 ft. 6 in. diam., obtuse corner bends and valve body assemblies (this comprises a total of approximately 4,000 ft. of ducting); the biological shield cooling system, comprising vertical double-skin, bottom ring main, bottom-pass steelwork, top-pass steelwork, external inlet ducting, extraction ducting and cooling sleeves; pressure-vessel cooling hood;

Fig. 1. General view of reactor building area showing progress made in the construction of the reactors and turbine house. The temporary cone roof on reactor in foreground enables work to proceed on the reactor vessel in all weather conditions. The picture was taken shortly before the first boiler shell was placed in position.

reactor pressure-vessel attachments including standpipes and ducts for debris removal, thermocouples and burst slug detection; CO_2 storage vessels, filter-vessels, including by-pass, vent and vacuum, safety-valve and CO_2 drier filter vessels; and miscellaneous fabricated equipment including mortuary tubes, sealing doors and closure plates, and shutter tubes.

The twelve boilers are each 18 ft. diam. and 109 ft. 6 in. high. The total weight of the empty shell when complete is 350 tons. Due to the size of this vessel, it is necessary to perform an appreciable proportion of fabrication work in a shop built on site. But for technical and economic considerations, it has been necessary to carry out most of the fabrication work at the company's Derby Works, and thus deliver the largest possible components to site.

Since access to the area is restricted to a single-track standard-gauge railway a short distance from the site, and several road routes of a secondary nature involving narrow, winding and steeply-graded sections, an alternative method of transporting boiler components had to be established. After a full investigation by the C.E.G.B., the harbour at Portmadoc was developed, and extensive improvements made to the 12 miles of road between Portmadoc and the site.

International Combustion Limited now transport completed boiler strakes 18 ft. wide and with a maximum height of 9 ft. 6 in., by road from Derby to Liverpool, where they are loaded on to small coastal ships and taken by sea to Portmadoc where they are unloaded by a 150-ton capacity jib crane on the specially-constructed quay, and transferred to road vehicles for the final section of the journey to site.

Site fabrication shop

The fabrication workshop on the site is situated at the northernmost end of the Goliath crane tracks, and is a "T"-shaped building 400 ft. long and 160 ft. wide. Within the buildings are areas for both boiler and ducting fabrication and element cleaning, as well as for the normal services of storage, maintenance, laboratory work, etc. On arrival from International Combustion's works at Derby, boiler strakes are welded into sub-assemblies, radiographed and then passed through the manipulation section where the sub-assemblies are welded into complete boiler shells. The boiler shells are completed on one of the two main assembly lines and afterwards are removed onto the workshop apron beneath the Goliath crane, prior to lifting into the stress-relieving furnace, shown in Fig. 5. CO_2 ducting sections, of which there will be a total length of about 4,000 ft., arrive from Derby in sizes which are most convenient for transportation and manufacture. They are taken into the ducting fabrication area and welded into suitable sizes for lifting into the reactor area. After delivery from Derby Works, the boiler elements, which provide some 500,000 sq. ft. of heating surface, are off-loaded and stored in the "boiler element area" before pickling. In the site fabrication shop, the tube element exteriors are cleaned to the required standards and then inserted in a canister for transport to the reactor building area. A hydrochloric-acid pickling-tank, a citric-acid washing-tank and water rinsing-tanks are provided for this purpose. After the elements have passed through these tanks, they are dried by hot filtered air and slid into canisters which have previously been internally-cleaned by a similar process. The stress-relieving furnace, which has a removable roof, hydraulic test plinths and cleaning and lifting plinths, has been installed in a position adjoining the site fabrication shop. This furnace and the associated equipment are served by the Goliath crane, which also transports the completed boiler shells to the reactor areas.

When assembly of the boiler shells has been completed in the site workshop, they are removed from the shop on the rotators, and then lifted by the Goliath crane and set down on the stress-relieving furnace pedestals. Thermocouples are fixed to the shell at some 96 internal and external points, which are, in turn, connected to instrument panels mounted in the adjacent control-cabin. Thus, metal temperatures can be closely watched and controlled during the period of temperature raising, soaking or relaxing. The roof of the furnace, which comprises 15 sections each weighing five tons, is replaced on the furnace body and sealed to prevent loss of heat during the heating cycle. Two oil-fired combustion chambers, placed one at each end of the furnace, provide the supply of hot gas to the furnace, while a recirculating-fan discharges the gas through the ducting into the vessel. The shell is heated from ambient temperature to 600 deg. C., at which temperature it is maintained for five hours, and then left to cool back to ambient. Depending on the prevailing weather conditions, the complete process is carried out in approximately seven days. Test plates, inserted both inside and outside the vessel during stress-relieving, are afterwards tested in the laboratory to ensure that the plate has been returned to its proper ductility and tensile strength after relaxation of the tri-axial stresses, caused during the welding processes.

Fig. 2. The 400-ton Goliath crane lifting a completed boiler shell on to the pedestals of the stress-relieving furnace.

When stress-relieving has been completed, the boiler shell is lifted from the furnace by the Goliath crane and lowered on to the adjacent hydraulic test plinths. Metal caps, used to cover the thermal sleeves during stress relieving, are removed, and replaced by screwed steel covers to withstand the hydraulic test pressure of 460 lb./sq. in. Domes are welded on to the inlet and outlet sleeves, and manhole doors are securely fastened. Some 800 tons of water are then poured into the vessel in several stages, at each of which the water is circulated through electric heaters of 520-kW capacity to maintain a reasonable shell temperature at all times during the filling operation. When the vessel has been filled, and the air extracted, pressure is raised to 460 lb./sq. in. by means of a three-throw ram-type pump. On completion of the test, pressure is allowed to drop, and then the vessel emptied. The seals are cut away from the sleeves of the vessel, which is then prepared for internal shot-blasting.

After completion of the hydraulic testing, the boiler shell is again lifted by the Goliath crane and placed on the cleaning and lifting plinths. The end domes and internal bracings are removed, and the complete inside surface of the vessel is shot-blasted. Seals are provided to prevent any contamination of the clean areas during this operation. The permanent supporting steelwork for the tube element banks is then installed, and the interior of the vessel is painted to preserve a very high degree of cleanliness.

For lifting the boiler shell into a vertical position, a tail-car structure (using a lifting girdle) is provided.

Fig. 3 (right). Boiler shell on one of the final assembly beds in the site fabrication shop. A special mechanism in the rotator idler controls endwise spiralling movement.

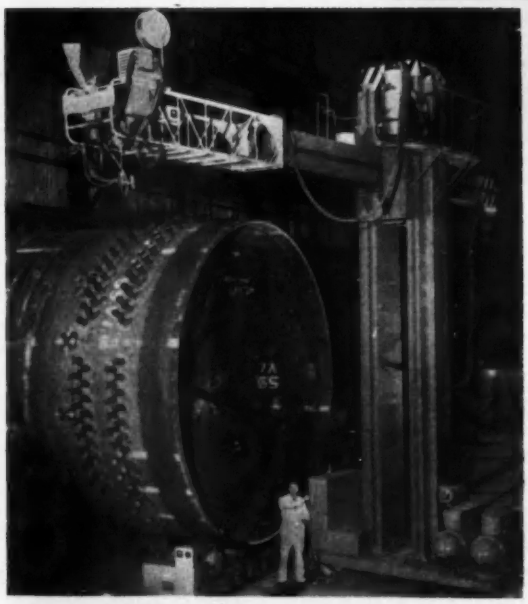


Fig. 4 (above). Boom welding equipment for circumferential seam welds. This machine moves along rail-tracks seen in the foreground of the illustration, and also rotates on the turntable above the base-plate.

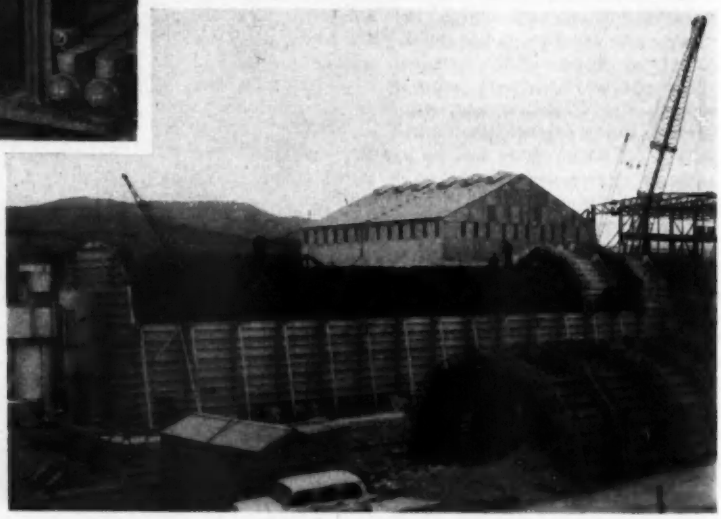


Fig. 5 (right). Boiler shell shown in the stress-relieving furnace before the complete roof of the furnace has been replaced ready for stress-relieving operations.

This tail-car, which is designed for a maximum load of 70-tons, can traverse a track as the vessel changes its inclination. Before the component reaches its vertical position, all load is taken on the lifting girdle. The vessel is finally transferred by the " Goliath " crane to its permanent position alongside the reactor.

A clean-conditions hut is then erected on the top of the boiler in order to prevent ingress of all foreign particles to the shell interior. The supply of air to the shell interior is maintained at a pressure slightly higher than atmospheric, and filters and de-humidification plant prevent moisture and the entry of particles into the shell with the air supply. The clean-conditions hut is provided with an air-lock to maintain pressure inside the shell.

All tube elements delivered from the site workshop are lifted into the clean-conditions building and removed from their canisters within this building. They are then lowered into the boiler shell and placed in position where they are supported from the permanent steelwork previously installed when the shell was horizontal.

When all the tube elements are in position, the ends of the boilers are sealed and the clean-conditions hut removed. To eliminate ingress of foreign particles before installation of the gas circuit, nitrogen bottles are used to inject gas into the boiler, thus ensuring that the pressure is slightly above atmospheric pressure. On completion of the gas circuit and final boiler welds, the full gas circuit, including the reactor and boiler vessels, is subjected to pneumatic pressure-test.

The heat-exchanger boiler design is based on heat transfer tests by International Combustion Limited in a special test-rig in which either air or CO_2 can be circulated at full working pressure and velocity. The finned-tube sections are arranged in eight banks for (from the top downwards) h.p. superheater ; l.p. superheater ; h.p. evaporator (arranged in two banks) ; h.p. economiser ; l.p. evaporator (two banks) ; and mixed (h.p./l.p.) economiser. The tube elements are arranged transverseley to the coolant flow, and, where the elements pass through the pressure-vessel wall, suitable sleeves are provided to avoid the incidence of undesirable stresses. All penetrations of the tube elements through the pressure vessel are radial, and are from the same side of the banks, an arrangement which reduces the amount of external pipework required and also enables the construction of the internal baffles to be simplified. The boiler is arranged to suit a dual-pressure steam-cycle, and has one l.p. and one h.p. steam drum. The evaporator banks consist of double-flow tube elements, and thus bifurcations are used to reduce the number of holes in the pressure-vessel wall and also the number of thermal sleeves. Assisted circulation through both h.p. and l.p. evaporator banks is employed, the circulation pumps being of the glandless electro-mersible type, supplied by Hayward, Tyler & Co. Ltd.

The fittings and mountings for the boilers are being supplied mainly by Hopkinsons Limited, and include Hopkinson-Ferranti valves, parallel-slide valves, isolating valves, check valves, safety-valve silencers, etc., and also water-level indicators including Bi-colour indicators. Hopkinsons Limited are also supplying some 66-in. bore " Tansphere " butterfly valves for control of CO_2 in the main gas ducting.

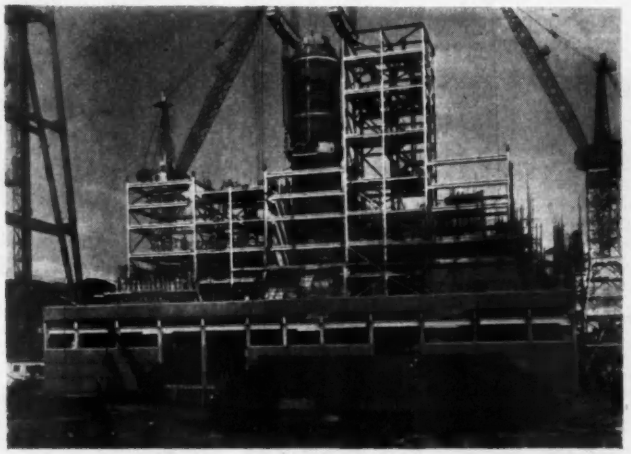


Fig. 6 (left). The first of the six boiler shells for No. 1 reactor being placed in its final position by the 400-ton " Goliath " crane.

Fig. 7 (above). Another view of this boiler shell in its vertical position alongside No. 1 reactor. In the foreground (and at ground level) can be seen part of the top section of the reactor pressure vessel being prepared before lifting into position.

Production at Derby Works

Having been able to get a clear picture of the engineering work involved, and to see numerous stages and methods of manufacture in the site workshop at Trawsfynydd, we were, by courtesy of International Combustion Limited, able to pay a supplementary visit to the company's Heavy Engineering Shop at Derby, and thus see some of the basic manufacturing processes undertaken before the components are transported to site, and also see the shop in full effective operation. The problems arising from the type and size of the equipment

for Trawsfynydd have been successfully overcome through close liaison between the people concerned at Derby Works, at the site fabrication shop, and the erection teams at the site.

The Heavy Engineering Shop building which was described in the May, 1951, issue of ENGINEERING AND BOILER HOUSE REVIEW, and which had been formally opened by Lord Mills, Minister of Power at that time, has an area of 68,250 sq. ft. The shop is divided into three bays, the centre bay being 75 ft. wide, and each wing bay 65 ft. wide. The overall length is 350 ft. and the height from the floor to crane rails is 40 ft. To provide additional headroom for the construction of vessels of very large diameter, the centre-bay contains a welding pit 150 ft. long × 25 ft. wide × 12 ft. deep. The floor of the pit carries manipulating equipment for rotating vessel sections during seam welding, and also provides an adequately-screened space for X-ray examination, in addition to the main X-ray and gamma-ray booths at the north end of the shop. Layout of machinery around the shop perimeter is well-suited to progressive stages of manufacture, each bay being served by two cranes, the heaviest of which is of 50 tons lifting capacity.

Raw material taken from the stock-yard is transferred into the main shop through the flame planer building, where the plates can be cut to size or shape, and initial weld preparations formed on the plate edges. Further edge-preparation for welding is carried out on either a large planer accommodating plates up to 35 ft. long, or on a standard planer which has a table 25 ft. long. Circumferential weld preparation is undertaken on a large centre lathe, or on a vertical boring machine. Two vertical presses, each of 3,000 tons capacity, together give a range of plate bending in various widths from 3 in.

Fig. 9 (above). The circumferential edges of the cone ends are prepared on this machine in the Derby Works. Additionally, the machining of a forged ring associated with the bottom cone assembly is undertaken on this machine.

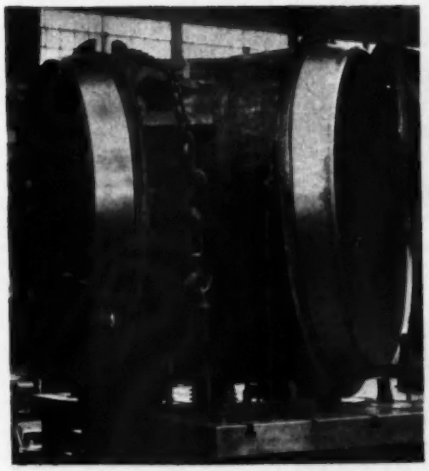


Fig. 8 (above). Obtuse corner bends for the main gas ducting are fabricated in the Heavy Engineering Shop at Derby.

Fig. 10 (right). Heavy Engineering Shop at Derby showing boiler shell strakes for Trawsfynydd in various stages of manufacture.

thick (cold) at a minimum diameter of 3 ft., up to 4 in. thick (cold) at 25 ft. diam. A four-column downstroking press of 2,000 tons capacity provides for the hot-pressing of dished ends, and segments for all diameters of vessels and drums. Lighter sections of plate up to 1½ in. thickness are manipulated in the power rolls.

The main welding machine is an automatic welder with a rising boom to accommodate vessels up to 12½ ft. diam., and 50 ft. in length. These vessels are manipulated under the welding-head by means of a roller bed installation. A number of other welding machines of the self-propelled automatic type are used together with such standard d.c. and a.c. sets as are required for the work in progress. A group of three furnaces centralised at the south-end of the shop provides for the heating of plates for dishing, and the heat treatment either of long medium-diameter vessels, or, of large-diameter sections of vessels. These are all town mains pressurised gas-fired furnaces, with full automatic temperature control, the temperature being recorded throughout the whole process. Two electrically-heated furnaces are also situated at the south-end of the shop for the stress-relieving of nuclear strake sections. The largest machine installed is a vertical borer which can be adjusted for work on vessels up to 25 ft. diam., and provides for cylindrical edge-preparation, general boring and facing. There is also a floor boring machine with a 3 in. diam. spindle. Tube-hole drilling, and profiling tube-stubs for welding, are catered for by a duplex horizontal boring machine.

For the cylindrical part of the Trawsfynydd boiler shells, boiler plates of 2 in. to 2½ in. thick are cold bent to semi-circular shape, two of which are then welded longitudinally to form a cylindrical strake. Cylindrical strakes in various stages of manufacture can be seen in Fig. 10. The two seen in the background are ready for radiography of the longitudinal seams.

During our visit we were able to see a very large amount of material and components for Trawsfynydd being dealt with. The headers for the 12 boilers are of more than ordinary interest. The ends of the header are specially designed to allow for the insertion of the introscope for periodic inspection. CO_2 detection equipment is also inserted so that faulty tubes can be quickly located when the boiler is "shut down." All tube connections are welded to the header shell, locally stress-relieved and fully-radiographed using iridium isotopes. The complete unit is then stress-relieved and hydraulically-tested to the requisite pressure.

A total of 482 stand-pipes are required for the two Trawsfynydd reactors. These have to be manufactured to stringent straightness tolerances, demanding a high standard of workmanship. All welding has to be to first class standards, and butt-welds are fully radiographed before hydraulic and pneumatic testing. These stand-pipes are also manufactured at the Derby Works.

The new and well-equipped heavy engineering shop at Derby Works has proved to be a valuable asset to International Combustion Limited, who, for many years, have taken a leading part in the design, development and manufacture of steam-generating plant and its associated equipment for electrical power generation, and also for a wide variety of industrial steam requirements both in this country and overseas. The illustration (Fig. 10) shows the interior of the new shop, and indicates the volume of production work at present being carried out therein. This production work includes plant for both nuclear and thermal power plant requirements. Significant among the many orders which International Combustion Limited have in hand at the present time, in addition to the 12 boilers and other equipment for Trawsfynydd, are a 550-MW reheat boiler for Thorpe Marsh Power Station, five 120-MW reheat units for the Central Thermo-Electric Station for Buenos Aires; two 200-MW units for Vales Point Power Station of the Electricity Commission of New South Wales; four 500-MW reheat controlled-circulation units, each of 3,450,000 lb./hr. capacity, for West Burton; and one of the units to operate at supercritical steam pressure (36,500 lb./sq. in.) at the new Drakelow "C" station of the C.E.G.B. This "once-through" unit will have a capacity of 2,500,000 lb./hr., and will supply steam at 1,110 deg. F. to a 375-MW turbo-alternator set. The new shop has also been used for the production of the steam generating plant and other equipment for the Advanced Gas-Cooled Reactor at the Windscale Works of the United Kingdom Atomic Energy Authority.

Electro-Mechanical Engineering Works

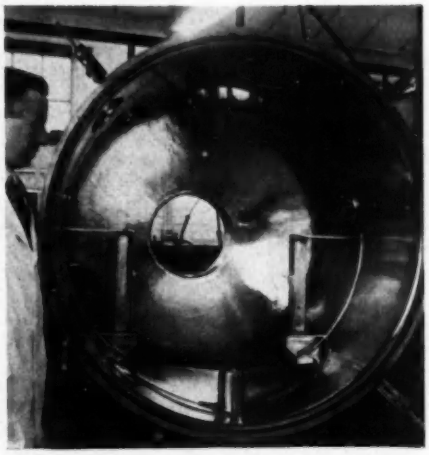
A VISIT to the Works at Horsham, of Lintott Engineering Limited, on the occasion of an "Open Day" held there recently, gave us the opportunity of seeing something of the varied electro-mechanical engineering work undertaken by this rapidly-expanding firm. The "Open Day" coincided with the completion of a new works extension which comprises a new and large shop equipped with the most modern machine tools and associated equipment. The commissioning of this new extension marks the completion of the third-stage of the development of the Lintott business.

The company had its origins in a millwrights and farm machinery manufacturing business which had been in existence since the first half of the nineteenth century. In the 1880's as the result of competition which arose and through various developments—some of continental origin—the firm was running into serious difficulties. At this time it was joined by the two brothers Lintott, who made rapid efforts to restore the fortunes of the firm. Under the new management, the company inaugurated an iron-foundry in Horsham, but its siting soon caused difficulties with the firm's neighbours and with the local authorities, due to nuisances caused by dust and noise. This state of affairs caused them to move to a new site (which is the present one) where, in addition to their foundry work, the firm began making various items of agricultural machinery, and soon afterwards began to make water pumps, and in fact various other types of

pump. The company continued to expand, and at the beginning of World War II, there were really three different sections, viz. electrical, water and heating, and the works themselves, which were engaged upon the manufacture of a general variety of engineering products.

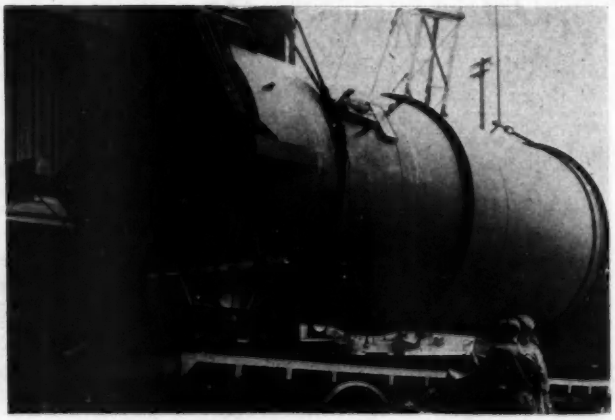
When the Lintotts retired in 1944, the company became part of the Ayling Industries Group. By 1948, intense competition, and the problems of obtaining labour and staff, made it extremely difficult to continue with outside contracting work, and as a result, the firm dropped this and concentrated on its works production, and general engineering activities. This work covers equipment in the field of atomic energy, and also includes steel fabrication and the design and manufacture of vacuum and pressure vessels for the chemical and petro-chemical industries. Among the special products made for the atomic energy industry are glove boxes for handling radioactive materials, and electromagnets for beam bending focussing and other requirements in nuclear particle physics. A typical example of glove box which we saw in production is the Mark 1A made to the design of the Atomic Energy Research Establishment, Harwell, which is intended for use when toxic or moderately radio-active substances have to be handled under " clean air " conditions. Basically, the box is of welded-steel construction finished with an epoxy-resin paint and fitted with viewing windows of " Perspex," the panels being located in the middle frame by " Clatonrite " by self-sealing rubber strip. Specimens in the box are handled through two gauntlet gloves, suction being effected by an air-ejector operated by compressed-air. Each box is tested during manufacture to —4 in. w.g pressure at which the specified leak rate, per hour, is less than 0.5 per cent. of the volume of the box. Magnets made for the Atomic Energy Research Establishment and other clients range in weight from a few pounds to 20 tons. One such electro-magnet, an example of which we saw, is arranged to be mounted on a turntable on site at Harwell, so that the orientation of the axis can be varied. The steel yoke, made up of eight blocks, weighs 17 tons and the aluminium water-cooled winding weighs three tons. The winding consists of 12 oval " pancake " coils with glass-fibre insulation, the conductor being $\frac{3}{4}$ in. square cross-section with a circular central hole for cooling-water. Another special equipment made by the firm is a four-pole, water-cooled, electromagnet, designed for focussing intense beams of nuclear particles in connection with the particle accelerator " Nimrod " at the Rutherford Laboratory of the National Institute for Research in Nuclear Science at Harwell.

(Left). Typical example of vacuum furnace vessel with copper cooling coil.



(Right). Interior of vacuum furnace vessel highly polished in stainless steel.

The company also fabricates control panels to its own designs and to customers' special requirements. A typical example of such a panel is for a control system recently installed in Southern Rhodesia for monitoring the processing of detergent from the stage where it emerges as a slurry from the mixing tank, to the packaging of the finished product. In this particular process, the slurry is dried by hot air (from an oil-fired heater) which is injected into the drying chamber at a pressure of 1,000 lb./sq. in. The control system regulates oil-injection and firing, air-heater temperature, circulation of hot air, and the movement of the slurry to give accurately-maintained drying conditions. Faulty combustion, leading to the production of smoke (which would



Typical example of a 21-ton fabricated vessel as used in the petroleum refining industry, being loaded for despatch from works.

discolour the product) is detected, an audible warning is given, and corrective adjustments are applied automatically.

To extend the scope of its work, the company has recently built and equipped a new fabricating shop where piece loads up to 10 tons can be handled. The new shop comprises a bay 435 ft. long with a floor area of about 16,000 sq. ft., and served by a 10-ton overhead electric travelling crane and by manipulators mounted on the shop floor. This new shop is divided into three areas:—preparation, assembly and welding, and inspection and testing. The company manufactures process and pressure vessels up to 8 ft. 6 in. dia. × 12 ft. long, and for pressures up to 3,000 lb./sq. in. A recently-completed example is a pressure vessel 24 in. dia. and 5 ft. long, with a wall thickness of 1½ in. to withstand a working pressure of 800 lb./sq. in. and a test pressure of 1,200 lb./sq. in. maintained for 24 hours. Large fabricated vessels up to 8 ft. 6 in. dia. × 28 ft. long and weighing perhaps 21 tons can be made in the works. The company also manufacture heaters of various types for the oil companies, and superheaters for the petro-chemical and other industries.

Apprentice Guild

In 1944, Lintott Engineering introduced a scheme for five-year industrial apprenticeships; but reference should be made here to an interesting experiment started in 1956 by Mr. Frank Ayling, Chairman and Managing Director of the company. This was the formation of the Lintott Guild. As its name implies, this body is a guild of indentured apprentices, but its object is the rather special one of providing boys with an opportunity for cultural and social training to supplement and enhance the value of their craft training. The Lintott Guild is a democratic organisation in which the boys, indentured apprentices between the ages of 16 and 21 years, elect their own chairman and board of six directors; elections are held every three months. The business is conducted formally and independently of the company's management, but Mr. Ayling himself is available, if consulted, to give advice on procedure. Committees are appointed by the Guild board as required; visits are arranged to other works, engineering establishments, and places of cultural interest, while lecturers are invited to address the members of the Guild on a variety of political, economic and social subjects. Regular fortnightly meetings are held to ensure that the board principles of the Guild are observed and necessary training in procedural matters is given. The result to date is proving very satisfactory, inasmuch that a degree of self-reliance and a desire for progress has been created. At present the Lintott Guild has a membership of thirty-seven. The Guild is a fine idea and it has been sufficiently successful to encourage Mr. Ayling to start a similar association of apprentices in another firm in the Ayling Group.

Fuel Economy at a Yorkshire Woollen Mill

W. & J. WHITEHEAD (LAISTERDYKE) LTD. are one of the foremost botany top makers, worsted spinners and woolcombers in the Bradford woollen trade. Although established more than a century ago, the company has always recognised that, in order to be competitive, full advantage must be made of technical progress. While keeping to the fore in the specialised engineering in the woollen trade, the essential service plant has not been neglected. The boiler house and plant have been completely replaced, and sufficient time has now elapsed to assess the improvements in performance and the financial benefits which have been achieved.

The old boiler house contained four cylindrical-type boilers 24 ft. long × 9 ft. 6 in. dia. which were fitted with sprinkler stokers, and operated with an induced-draught fan. A 480-tube vertical-type economiser was provided, but in spite of this, a boiler efficiency of little over 60 per cent. was obtainable, although expensive graded coals, such as singles and doubles, were burnt. Furthermore, there was a considerable smoke nuisance and, for numerous other reasons, the actual boiler house site was becoming inconvenient. An entirely new boiler house was built therefore, complete with all new plant, and the old building is now used for storage purposes.

The new plant comprises three Daniel Adamson "Super-Lancashire" boilers which are fitted with Bennis chain-grate stokers. This type of boiler can be regarded as a compromise between an "Economic" and a "Lancashire-type" boiler. It combines the compactness of the multi-tubular type unit with the proved reliability of the "Lancashire" design, resulting in high thermal efficiency and large storage capacity. Briefly, the "Super-Lancashire" boiler is a two-pass boiler, working in conjunction with an air pre-heater which normally consists of a series of tubes running longitudinally from front to rear on each side of the boiler. These tubes convey the hot gases at the front of the boiler, from the second-pass tubes, to the chimney, via an induced-draught fan, in this case a Howden combined grit-arrestor type, and are enclosed in a duct, through which the air for combustion is forced by a fan on each side, to the front of the main combustion flues. In this particular installation the primary air in the forced-draught system is pre-heated to about 270 deg. F. Before making the decision to purchase this plant, a careful assessment of all factors was made, and other fuels, in particular oil, were considered. Running costs using oil as the fuel would have been considerably higher than with coal, while on the supply question, the source of the coal was less than 12 miles away. Each of the 10 ft. 6 in. dia. × 20 ft. long boilers is fitted with a pair of Bennis chain-grate stokers, with which an output of up to 15,000 lb./hr. of steam at 212 deg. F. is obtainable, with a thermal efficiency of over 80 per cent.

The boiler house complete cost £81,000 and an immediate saving of £800 annually in labour charges was achieved. In the first full year of operation the coal consumption was 8,270 tons of washed smalls, costing £32,682, as against 9,364 tons of graded coal in the

previous year costing £42,371, giving a saving of £9,689. The following year the fuel savings were £12,688 allowing for adjustment in price, and the next two years £15,711 and £15,413 respectively. It is now obvious that the total capital expenditure will be recouped within less than six years, with considerable yearly savings thereafter. While considering these figures, it must be borne in mind that since the old boilers were replaced, there has been a 25 per cent. increase in manufacturing capacity, so that the real savings are even greater, apart from the fact that the old plant could not have coped with the rising load.

Boiler firing aisle showing the Bennis chain-grate stokers fitted to the three Daniel Adamson "Super-Lancashire" boilers.

One of the duties of the boiler plant is to supply steam at 190 lb./sq. in. to a Sulzer engine driving a 1,250 kVA alternator of General Electric Company Manufacture. About two-thirds of the steam produced is for process work involved in wool combing. There are at present four sets of wool-scouring bowls, each consisting of four hot water bowls and one drier, the latter being heated by steam coils, and the scouring tanks through a Cox mixer-type hot-water boiler. As might be expected, the demand from the scouring bowls is intermittent, and to cope with heavy fluctuations in load, two of the old boilers have been converted into steam storage vessels. A Unit superheater is fitted in each boiler, and the steam enters the storage vessels at 550 deg. F. with an outlet temperature of about 365 deg. F.

Feed water is supplied to the boilers at about 150 deg. F. and comprises 45 per cent. condensate return with the remainder as fresh feed. A Mather and Platt electric pump with a capacity of 85 gal./min. is installed, with a Weir steam pump as a reserve.

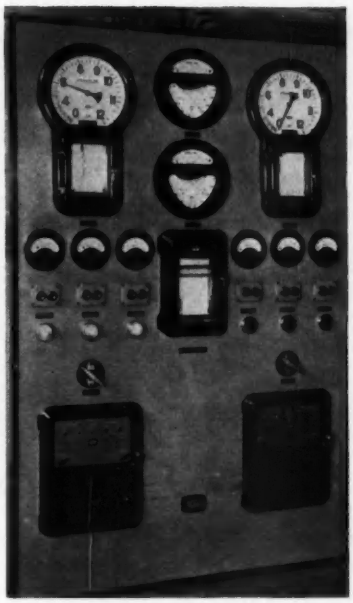
Coal-handling is by means of a Bennis elevator and cross conveyor, feeding into the hoppers over the front of each chain-grate stoker. The plant is conventionally instrumented, with indication of steam temperature, draught and CO_2, which averages between 12.4 and 14 per cent.

The whole plant constitutes a highly-efficient steam generating unit which completely meets the heavy load fluctuations, and which produces steam at low cost and completely smokelessly, using locally produced fuel. The use of mechanical handling and boiler controls ensure that labour requirements are reduced to a minimum, while the cleanliness of operation compares favourably with any other fuel.

Automatic Control of Hospital Boiler Plant

ONE of the main reasons for the installation of automatic boiler control at the General Hospital of the Birmingham United Hospital Group, was to obtain a reduction of smoke emission. This control equipment was supplied by Smiths Industrial Division, Wembley, Middlesex. During the 12 months the equipment has been in operation, this objective has been realised and the reduced operating costs, resulting from a 3.45 per cent. increase in boiler efficiency, will, it is stated, cover the cost of the equipment within the next six months. Prior to the installation of the control equipment, the boilers were operating at the relatively high thermal efficiency of 71.2 per cent., but a study of the statistics provided by the chief engineer, covering two periods of six months operation, on manual and automatic firing, showed an increase of 3.45 per cent., with a saving of 93 tons of fuel. This saving was achieved in spite of a change to a lower grade fuel, and represents one-third of the cost of the control equipment. The installation consists of four H. & T. Danks Super-Economic boilers, each 10 ft. dia., 16 ft. long over tube plates, 22 ft. long overall, each capable of a duty of 10,000 lb./hr. from feedwater at 150 deg. F. The design pressure is 150 lb./sq. in. but the boilers operate at 100 lb./sq. in. Fuel used is Birch Coppice and Cannock Chase washed beans of an average calorific value of 10,920, and is fired by Hodgkinson "Low-Ram" stokers. The steam and water mountings for these boilers were supplied by Hopkinsons Ltd., while Ronald Trist and Co. Ltd. supplied the high- and low-water alarms. Aerodynamic grit-collectors, I.D. fans and ducting were all supplied by Musgrave and Co. Ltd. A master pressure-controller is situated in the main steam-header to provide an advance warning of fluctuating loads. Pulsed signals, proportional to the fluctuating steam pressures, are relayed by the master controller to individual combustion controllers which regulate the coal-feed and air-flow to each boiler. Coal-feed is regulated by the cyclic operation of the constant-speed a.c. stoker motors, the running time being proportional to the load, as indicated by the master controller. Air-flow is controlled by a motorised damper operating through a push rod and reduction gear. The controllers are balanced to permit load-sharing and, once set, should require no

(Above). Boiler firing aisle showing part of the four H. & T. Danks Super-Economic boilers which are fired by Hodgkinson " Low-Ram " stokers.



(Right). One of the instrument panels supplied by Smiths Industrial Division showing combustion controllers, stripchart recorders and lossmeters.

further attention; provision is also made on the controllers to enable the operator to change over to manual operation.

The figures given in the two following tables were supplied by the Chief Engineer of the Birmingham General Hospital and cover six monthly periods of operation on manual and automatic firing respectively.

Manual control

Period July to December 1958. Average C.V. of Fuel 11,360 B.Th.U./lb.

	Total Steam (lb.)	*Total Fuel (tons)*	*lb. Steam/lb. Fuel*	*Thermal Efficiency (per cent.)*
July ...	3,313,000	177	8.356	71.97
Aug. ...	4,131,000	221	8.347	71.90
Sept. ...	3,559,000	195	8.149	70.20
Oct. ...	5,005,000	262	8.529	73.47
Nov. ...	7,812,000	420	8.307	71.55
Dec. ...	7,026,000	378	8.299	71.48
Totals: ...	**30,846,000**	**1,579**	**Mean av. 8.331**	**Mean av. 71.76**

Automatic control

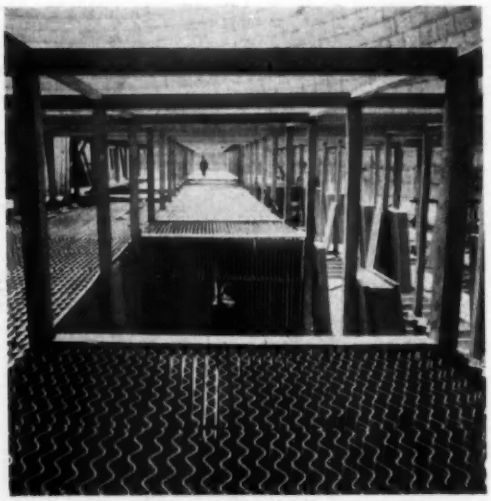
Period July to December 1960. Average C.V. of Fuel 10,920 B.Th.U./lb.

	Total Steam (lb.)	*Total Fuel (tons)*	*lb. Steam/lb. Fuel*	*Thermal Efficiency (per cent.)*
July ...	4,051,000	217	8.335	74.69
Aug. ...	3,300,000	176	8.371	75.02
Sept. ...	3,630,000	195	8.312	74.49
Oct. ...	7,879,000	423	8.318	74.54
Nov. ...	7,436,000	394	8.428	75.53
Dec. ...	8,159,000	424	8.592	77.00
Totals: ...	**34,455,000**	**1,829**	**Mean av. 8.392**	**Mean av. 75.21**

Manual operation during the 1960 period would have produced 8.007 lb. of steam per lb. of fuel. Therefore, a total of 34,455,000 lb. of steam would have required 1,922 tons of fuel. Fuel saving on automatic operation was therefore 1,922—1,829 = 93 tons. At an average cost of £4 12s. 6d. per ton, this represents a fuel saving of £430 2s. 6d. in six months, which is equivalent to one third of the cost of the equipment.

ASBESTOS CEMENT IN COOLING TOWER CONSTRUCTION

Even in the days when power station cooling-towers were of timber-framed and boarded construction, asbestos cement was used for the pipework, distributing branches and spray nozzles. When the material had proved its reliability over a number of years, it was logical to experiment with asbestos cement internal packings as it seemed likely that there would be very much less maintenance than with the conventional packing of timber slats. For some years, the Universal Asbestos Manufacturing Co. Ltd., Tolpits, Watford, Herts., has been trying out experimental tower packs in co-operation with specialists in cooling-tower design. One of the first was a small tower at Leicester power station, which was repacked in 1945 with asbestos cement corrugated sheets, secured by bronze bolts and spacers, and with the corrugations all in one plane. More recently, the company have evolved a simple and efficient type of cooling pack which needs no spacers or other fixings. In this pack, 6-in. corrugated sheets with the corrugations running vertically, are interleaved with 3-in. corrugated sheets with the corrugations running horizontally. The multiple points of contact between the corrugations give considerable strength and rigidity to the packs, so that the sheets can be made somewhat thinner than the normal roofing grade. This is claimed to produce a substantial saving even for a small tower. The first towers to contain packs of this type are at the new Padiham "B" generating station, (C.E.G.B., North Western Division). These towers were designed by L. G. Mouchel & Partners, and built by the Mitchell Construction Co. Ltd. The two towers are 300 ft. high and have a diameter at pond sill level of 190 ft. Each tower handles 3½ million gal./hr. of cooling-water, and produces a temperature drop of about 18 deg. F. Precast reinforced-concrete columns and bearer beams are used to support the asbestos cement packs, which were made up on site. The sheets were delivered in bulk and stacked in the catchment pond below, before being hoisted to the bottom part of the tower ready for making up into packs. A detailed fixing plant was prepared by the Site Agent and a U.A.M. Consultant, and as a result the transporting, handling and packing of the sheets was carried out so simply and efficiently that six fixers succeeded in packing over 100 tons a week, and site breakages were considerably less than anticipated; only



Interior of a cooling tower showing the reinforced concrete columns and bearer beams and the fitting of the asbestos cement cooling packs.

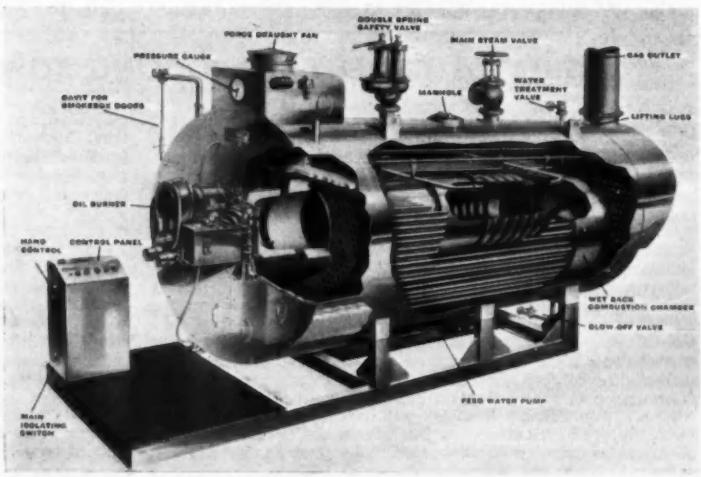
The spray pipes are supported by small cast concrete bearers resting directly on the asbestos cement sheeting.

one sheet in every 400. As their experience increased, the fixers at one stage packed over 140 tons in one week. At the perimeter of the tower is a ring of radial sheets, but the remainder are set in a series of rectangular packs and carry the spray pipes, which are fitted on small pre-cast bearers. The spray pipes are fitted with a series of distributor heads spaced at approximately 2 ft. 6 in. centres. Above them, asbestos cement eliminator slats, made from a single 6-in. corrugation, are fitted into a series of splayed castellations on the side faces of the upper beams. These eliminators perform the very necessary function of preventing small water droplets from being carried up and out of the tower, and keep water losses to a minimum. The above illustrations show the building of the packs before the spray nozzles and eliminator slats were fitted.

THE MULTIPAC PACKAGED-TYPE BOILER

During the past 12 months, some 120 oil-fired " Multipac " wet-back package boiler units (British Patent No. 861,231) have been sold for installation in a multiplicity of industries and public services. " Multipacs," which are designed and manufactured by John Thompson (Wilson Boilers) Limited at their Glasgow Works, are performing a steady, reliable and economical service in almost every branch of industry where steam is required. Factories, oil-refineries, mills, distilleries, processing plants, chemical works, laundries, etc.—all have installed " Multipacs." In many instances, steam is produced for 24 hours per day, confirming the reliability for which the " Multipac " has earned an enviable reputation. Furthermore, this compactly-designed package boiler offers particular advantages in respect of its high degree of quiet operation, where this feature has commended itself to hospitals, colleges, public buildings, office blocks—where many " Multipacs " have been installed.

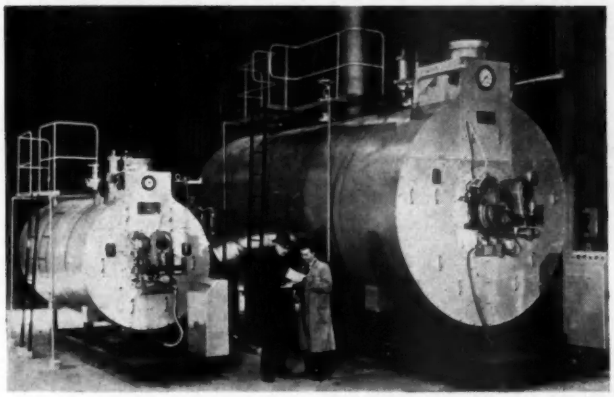
The " Multipac " is manufactured in a number of standard sizes, the range comprising 20 models covering an evaporation from 2,000 to 25,000 lb./hr., from and at 212 deg. F., with any model being suitable for modification to suit client's special requirements. In common with several other package boilers, the " Multipac " is basically a treble-pass unit modified to incorporate high intensity oil-burners and small furnace tubes, using a forced-draught system in lieu of induced-draught, which is associated with the older type of shell boiler. But the " Multipac " is much more than a treble-pass shell-type boiler, for embodied in its design are features which ensure faster steam-raising, greater flexibility and longer life—all factors of prime importance. The first-pass of the boiler comprises a furnace tube, of approximately half-plain, half-corrugated section, while the remaining passes are through two nests of small-bore smoketubes. The combustion chamber is of the



Cut-away illustration of the " Multipac " wet-back packaged boiler showing gas-pass arrangement, and absence of refractories in the combustion chamber.

wet-back type, fitted inside the boiler, and completely surrounded by water, thus providing valuable radiant heat transfer surface. The dish-end construction of the combustion chamber, together with the corrugated section of the furnace tube, offers extreme flexibility under the most arduous operating conditions.

An interesting feature of the "Multipac" is the complete elimination of refractory lining in the combustion-chamber, obviating costly shut-downs required for its maintenance. In point of fact, the only refractory used in the boiler is for the lining of the combustion-chamber access-door. The reversing chamber at the front of the boiler is completely insulated and has two large doors which, when swung out on their davits give access to all tube-nests for cleaning. The gas exit from the boiler can be taken from the top or from the bottom of the rear smokebox as may be required by site conditions. The boiler unit is fitted with sheet metal clad insulation, and stands on a robust fabricated base.



The smallest and largest of "Multipacs" completed and steam-tested, awaiting despatch from the Glasgow works of John Thompson (Wilson Boilers) Limited.

The fully-automatic fully-modulating rotary cup burner is capable of burning the complete range of fuel oils available, without a pumping and heating set being necessary, when the oil tank is adjacent to the boiler house. The "Multipac," being a pressurised unit, is fitted with a double-stage forced-draught fan supplying all secondary-air for combustion. The fan is of the axial-flow type, fitted with two low h.p. motors incorporated in a specially-designed integral smoke-box. A multi-bladed damper which is provided at the outlet of the fan, controls the supply of secondary air to the furnace.

Though the standard "Multipac" is an automatic oil-burning boiler, a further model—the "Multipac S.F."—is available, designed for coal-firing. This model has a larger flue to accommodate a mechanical stoker, and many installations already include this type of "Multipac." It can be supplied with a stoker, ready for coal-firing, or with an oil-burner, with provision for subsequent conversion to coal burning. It is of interest to note that since developing the "Multipac" range, John Thompson (Wilson Boilers) have introduced the "Demipac" to meet the demand of the smaller steam user who requires a fully-automatic boiler at a low capital cost and capable of utilising the heavier fuel oils. This model is manufactured in a number of models covering an evaporative range from 500 to 2,500 lb./hr., and this packaged boiler, too, can be supplied as an oil-fired or coal-fired unit.

A large and fully-equipped test bay is installed at the Glasgow Works of John Thompson (Wilson Boilers) Limited, where all package boilers undergo rigorous tests before dispatch. All units are, therefore, on arrival at site, ready for connecting to supply lines with an absolute minimum of delay before being available for operation. To deal with the large number of welded shells which are being produced for the specialist business of package boiler manufacture, an electric stress-relieving furnace was installed at the works last year. The largest of its type in Europe, the furnace comprises a rigid steel structure, lined on the inside with low thermal mass insulation and fitted with electric heating elements of heavy section on all four sides, the base and roof.

Wilson boilers were first made in 1825 when the business was established under the name of William Wilson. The original works occupied an area of only 836 sq. yd., but by 1875 this had been increased to 2,010 sq. yd. and the name of the firm was changed to William Wilson & Company. In 1923, the name was again changed to Wilson Boilermakers Limited, and in 1933 the company joined the John Thompson Group. Since that date, buildings and plant have been added to, and improved upon, until, at the present time, the area occupied by the works is more than 20,000 sq. yd., with further additions being carried out.

FOSTER WHEELER HOUSE

In the May issue of this journal we published a short note concerning Foster Wheeler House, the new head office in Chapel Street, London, N.W.1, of Foster Wheeler Limited. The official opening ceremony of the new building was held on Friday evening, June 16th, the ceremony being performed by the deputy-mayor of St. Marylebone, Lt. Col. W. A. N. Hammond, O.B.E., T.D., in the presence of Mr. J. H. Kenny, president of Foster Wheeler Corporation, New York, Mr. C. E. H. Verity, O.B.E., managing director of Foster Wheeler Limited, and about 100 guests, representing the many branches of industry with which the company is associated. After the opening ceremony, the guests were invited to tour this 17-storey building, which has now become one of London's landmarks.

Foster Wheeler Limited forms part of the world-wide Foster Wheeler organisation and has been established in London for 40 years, specialising in the design, fabrication and construction of petroleum and chemical process plants, complete refineries, marine and land-type boilers, and nuclear power plants. The head office in 1920 was at Aldwych House, W.C.2, and had a staff of 27, subsequently moving to Ixworth Place, South Kensington. With further expansion in all departments, and with a staff now numbering 1,350 it was found necessary to move to larger premises, and this has now been completed with the occupation of the new building in Chapel Street. The Foster Wheeler organisation has designed and built oil-refinery plants for many home and oversea installations, including those in Grangemouth, Isle of Grain, Llandarcy, Stanlow, Shellhaven and Coryton, in addition to refineries at Abadan, Kirkuk, Durban, Trinidad and Sydney. Process plants for chemical and petrochemical products such as ammonia, butyl rubber, ethylene, fertilisers, plastics, phthalic anhydride, and sulphur are produced from process plants designed and built by Foster Wheeler. The company has designed marine boilers for the past 20 years—over 880 marine boilers of Foster Wheeler design are now in service. These boilers vary in evaporative capacities from 5,000 lb./hr. auxiliary boilers, to the 260,000 lb./hr. boilers for the S.S. *Canberra*. In recent years, an advanced design of marine boiler has been produced and is now in extensive service. Known as the External Superheater "D" Type (ESD), this design of marine boiler is in service in some 82 ships, comprising dry-cargo vessels, liners and oil tank ships up to 73,000 tons displacement. Many further boilers of this type are now being built for ships under construction in the United Kingdom, and the type is in service in such liners as the *Canberra*, *Oriana* and *Transvaal Castle*. Foster Wheeler design, manufacture and build water-tube boilers of all sizes for power stations and

industrial installations, ranging from the small shop-assembled units which are dispatched complete to site, up to some of the largest boilers required by the C.E.G.B. Typical of the earlier Foster Wheeler installations in the United Kingdom are the stoker-fired boilers at Deptford East Power Station, where four

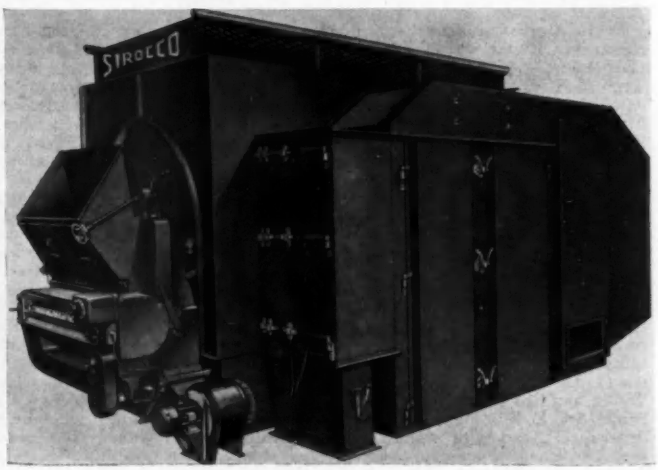
The Deputy Mayor of St. Marylebone being received by Mr. J. H. Kennedy, President of Foster Wheeler Corporation, and Mr. C. E. H. Verity, O.B.E., Managing Director of Foster Wheeler Limited, at the official opening.

units each provide 250,000 lb./hr. of steam, and the four oil-fired boilers each providing 475,000 lb./hr., at Bankside Power Station. More recent examples of boilers of Foster Wheeler design may be found in the six large reheat boilers at Aberthaw Power Station, each providing 760,000 lb./hr. at 1,600 lb./sq. in. and 985 deg. F. when fired with low volatile coal of the anthracite type; six reheat boilers at Northfleet Power Station, Kent; and three similar boilers at Drakelow "B," each of 860,000 lb./hr. capacity at 1,600 lb./sq. in. and 1,010 deg. F. Continuing along the modern trend of large capacity units, Foster Wheeler Limited have been awarded, in association with John Brown Land Boilers Limited, the boiler contract for Tilbury "B" Power Station. This installation will consist of four reheat boilers each of 2,350,000 lb./hr. at 2,400 lb./sq. in. and 1,050 deg. F.

The company first established a major interest in nuclear power development in 1951 when study work was undertaken on behalf of A.E.R.E. Harwell. Since then numerous contracts have been obtained to design, manufacture and operate a variety of equipment, including test facilities, for investigating heat transfer, fluid flow, and strength of materials for various types of nuclear reactor coolant systems. A technical group having specialised knowledge in almost branches of engineering, and in the exact requirements of the nuclear industry, has at its disposal a research and development laboratory at the company's Egham works, together with an assembly show and clean conditions room. This is supported by the wide range of machining, fabricating, inspecting and testing facilities of the company.

NEW 'SIROCCO' AIR-HEATER

A new single-circuit air-heater which is claimed to achieve very high thermal efficiencies by using the incoming air as a coolant along the hot surfaces of the furnace shell, has been produced by Davidson & Co. Ltd., Sirocco Engineering Works, Belfast. Known as the "Sirocco" S.C.D. air-heater, it is made in three sizes, and has been developed from the company's range of multi-tubular type air-heaters. Although originally designed for the tea industry, the S.C.D. is suitable for crop-drying generally, and is expected to find many applications in space heating and industrial processing plant. It is adaptable for use with almost any type of fuel, and apart from a substantial reduction in initial cost as compared with the existing range of air-heaters, the S.C.D. is claimed to be particularly economical to operate, owing to its greater thermal efficiency. The system of routing the incoming air over the high-temperature furnace top, and back combustion-chamber surfaces, tends to prevent any burning out of these members even at the maximum ratings quoted, provided firing is reasonably efficient. The consequent warming of the incoming air before meeting the tube-banks ensures that these do not fall below moisture dew-point, thus almost eliminating corrosion and prolonging the effective life of the tubes. The flue-gas circuit is from the furnace to the back flue or back combustion chamber, through a "single-pass" assembly of banks of oval tubes (identical to those of the company's previous No. 10 air-heater, but graduated in number according to the output of the S.C.D. heater), and thence to the flues via the front smoke-boxes which are furnished with the usual wide doors for easy tube-cleaning. These smoke-boxes may be arranged to exhaust the flue-gases either to overhead or underground flues. Soot-removal doors are also provided at each side of the back flue or back combustion chamber. The furnaces, which are unaltered from previous proven designs, may be adapted for either solid, liquid or gaseous fuels. Solid fuel, such as wood or coal, may be introduced by hand-firing, but where coal is plentiful, the use of an "Oldbury" chain-grate stoker with a Davidson "Sirocco" forced-draught fan provides the required degree of controlled firing for maximum heat-extraction. For use with oil fuel equipment, the furnaces are, as usual, partially lined with refractory brickwork to approved pattern, in order to protect the lower portion of the arch bars and the backplate from direct-contact with the very high temperature flame from the oil-burners; this ensures



The "Sirocco" S.C.D. air-heater as fitted with an Oldbury chain-grate stoker and Davidson "Sirocco" forced-draught fan.

long life for these components without impairment of their efficiency. Suitable oil-burning equipment may be supplied for either light distillate or heavy furnace oils. Accessories such as preheaters and furnace safeguard electronic control equipment are also available. Where gaseous fuel is the most economical, the furnace may be lined with refractory brickwork as for oil-burning, and the furnace front mounted with suitable gas-burners; the combustion air for the burners is then supplied by a "Sirocco" rotary blower of single or two-stage type according to requirements.

INTERNATIONAL SYSTEMS CONTROL LIMITED

The General Electric Co. Ltd., and **Thompson Ramo Wooldridge Inc. (TRW),** of Los Angeles, U.S.A., have formed a new joint British Company, with its headquarters in London, to market industrial process control systems in Great Britain, the European Free Trade Area and the Commonwealth. The new company, **International Systems Control Ltd.,** will operate initially with a capital of £430,000, equally shared by the parent companies. In their roles as parent companies, TRW Inc. will be contributing the technical "know how" of process control systems, including computer designs, while G.E.C. Ltd. will make available all relevant patents, key personnel and, in particular, its advanced electronic engineering resources, and its experience and extensive facilities for the manufacture of precision electronic equipment. The new company will have its own laboratories, and a staff of from 50 to 70 will be gradually built up during the next two years. Its engineers will act mainly in a consultative capacity, designing systems rather than individual items of equipment. To carry out its work of applying computers to industry, the staff of I.S.C. Ltd. must be of the highest calibre and must include senior engineers with much operating experience in each of the industries it is to serve. The "RW-300" digital control computer which will be made by the company is the first digital computer engineered specifically for automatic control of industrial processes, for data logging and for test-stand operation. T.R.W. Inc. have computer applications in the fields of steel, steam and nuclear power, chemical and petroleum, cement, testing and data reduction. "RW" computers were, it is claimed, the first to be produced, and the first to be used in closed-loop control. In the near future, "RW" computers will be monitoring and controlling the three largest steam power plants in the U.S.A., and also the largest basic oxygen steel process in the world. Speaking at a press conference in London recently, Mr. O. W. Humphreys, C.B.E., chairman of the new company and technical director of G.E.C. Ltd., said, when introducing the other members of the board of I.S.C. Ltd., that the fact that G.E.C. Ltd. had been willing to release Dr. D. N. Truscott, O.B.E., from his position as general manager of its Electronics Division, and that T.R.W. Inc. had been prepared to transfer Dr. E. M. Grabbe, its senior staff consultant on automation, for full-time service with the new company, underlines the importance of the new venture. The other three non-executive members of the board are Mr G. W. Fenimore (vice-president T.R.W. International); Mr W. A. C. Maskell (managing director of G.E.C. Ltd. Telecommunications Group) and Mr. M. E. Mohr (vice-president, Electronic Systems and Equipment Group, T.R.W. Inc.). It is hoped that the background of G.E.C. Ltd. in thermal and nuclear power generation, and its position as one of the largest manufacturers of electrical and mechanical equipment for the world's industries, together with the extensive experience of T.R.W. Inc. will enable the new company to occupy a unique position in the potentially vast field of automation.

C.E.G.B. REGIONAL APPOINTMENTS

Following the regional reorganisation of the Central Electricity Generating Board, the following appointments of deputy and assistant regional directors, with effect from July 1st, 1961, have been made.

South Eastern Region

Mr. L. W. Stretton, M.I.E.E., formerly acting assistant regional director, North Thames Division, becomes deputy regional director.

Mr. F. W. Skelcher, M.I.Mech.E., M.I.E.E., formerly divisional controller, Midlands Division, becomes assistant regional director (North Thames Division).

Mr. W. H. Dunkley, B.Sc., M.I.Mech.E., M.I.E.E., formerly acting assistant regional director, South Thames Division, becomes assistant regional director (South Thames Division).

South Western Region

Mr. R. H. Coates, B.Sc.(Eng.), M.Inst.C.E., M.I.Mech.E., M.I.E.E., F.B.I.M., formerly divisional controller, Southern Division, becomes deputy regional director.

Mr. E. McCabe, M.I.Mech.E., M.I.E.E., M.Inst.F., formerly chief generation engineer, Southern Division, becomes assistant regional director (Southern Division).

Mr. H. S. Davidson, T.D., M.I.E.E., formerly divisional controller, South Western Division, becomes assistant regional director (Western Division).

Mr. W. Wilde, B.Sc.(Eng.), M.I.E.E., M.I.Mech.E., M.Inst.F., formerly divisional controller, South Wales Division, becomes assistant regional director (South Wales Division).

Midlands Region

Mr. J. B. Jackson, M.I.Mech.E., M.I.E.E., formerly divisional controller, North Eastern Division, becomes deputy regional director.

Mr. W. F. Cusworth, B.Sc.(Eng.), A.M.I.E.E., formerly generation engineer, Eastern Division, becomes assistant regional director (West Midlands Division).

Mr. O. S. Woods, M.I.Mech.E., M.I.E.E., M.Inst.F., formerly divisional controller, East Midlands Division, becomes assistant regional director (East Midlands Division).

North Eastern Region

Mr. C. G. Richards, M.Sc.(Tech.), A.M.I.Mech.E., A.M.I.E.E., formerly divisional controller, Yorkshire Division, becomes deputy regional director.

Mr. E. Forth, B.Sc., M.I.Mech.E., formerly chief generation engineer, North Eastern Division, becomes assistant regional director (Northern Division).

Mr. G. B. Jackson, D.F.H., M.I.E.E., overhead line engineer, Transmission Department, Headquarters, becomes assistant regional director (Yorkshire Division).

North Western Region

Mr. J. L. Ashworth, A.M.I.Mech.E., A.M.I.E.E., A.R.T.C.(S.), formerly deputy regional director, North West, Merseyside and North Wales Region, becomes deputy regional director.

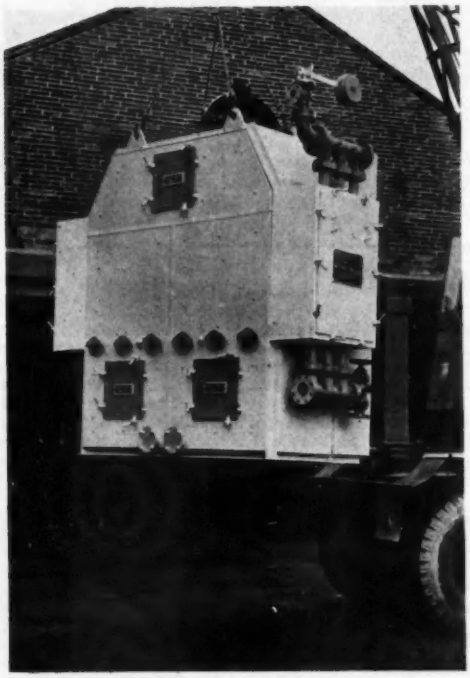
Mr. D. F. Grant, A.M.I.E.E., formerly chief generation engineer, North West, Merseyside and North Wales Region, becomes assistant regional director.

N.I.F.E.S. COURSES

In response to popular demand, the **National Industrial Fuel Efficiency Service** is repeating the Course on the "Latest Developments in Solid Fuel Firing Equipment" which was held recently at Manchester. The new courses will commence at 2 p.m. on Mondays, October 2nd and December 4th, 1961, and February 5th and April 2nd, 1962, respectively, and will finish at 3.15 p.m. on the following Fridays. The course fee is 12 guineas (excluding hotel accommodation). The course includes a comprehensive introduction to the latest combustion equipment and automatic controls that are now available to industrial and commercial users of solid fuel. Visits to several industrial plants, where new equipment has been installed recently and is in operation, will be made during the course. It will also include sessions on the maintenance of boilers, mechanical stokers, and firing equipment, and the choice of suitable fuels. Enrolment forms and further information, including a detailed syllabus, can be obtained from: N.I.F.E.S., 71, Grosvenor Street, London, W.1. (Telephone Hyde Park 9706.)

Economiser for Small Boilers

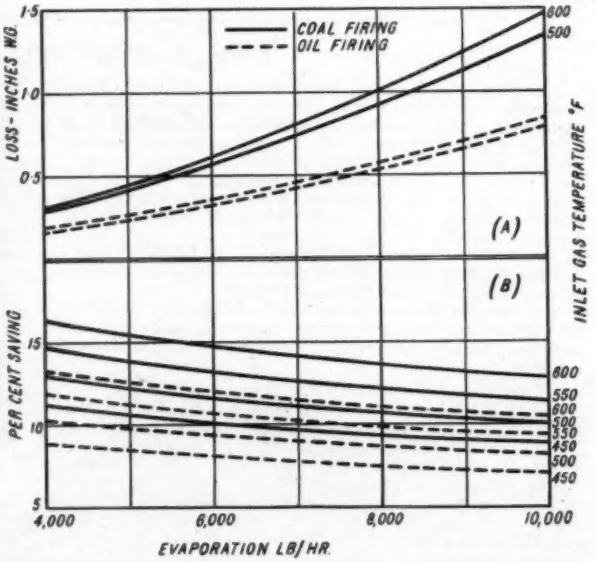
To enable small boiler plants, having an evaporative capacity ranging from 2,000 lb. to 12,000 lb./hr., to achieve the best possible fuel economy or steaming capacity, E. Green & Sons Ltd., Wakefield, has introduced a compact economiser unit. This is known as the " Unicon " and, as seen in the accompanying illustration, it is in the form of a self-contained shop-assembled unit, completely-cased and insulated with dampers and duct connections, and placed between the boiler and induced-draught fan, to provide maximum performance while occupying the minimum amount of space. The design is based on the well-proven Green's Premier Diamond type 25 economiser, but is in no sense a scaled-down version of this unit. It is a full-size economiser, employing



(Above). A " Unicon " economiser for small boiler units. (Right). Performance curves (A) economiser draught loss, and (B) fuel saving due to economiser.

	Coal	Oil
Gases per 1 lb. water	2·5 lb.	1·8 lb.
Boiler pressure lb./sq. in. (no superheat) ..	120	120
Feed water temperature, deg. F.	120	140

standard cast-iron gilled tubes and connecting bends, and the Diamond-shaped tube body and rectangular fins give high rates of heat transfer with low draught loss. Four sizes of " Unicon " are available, with 12, 16, 18 and 24 tubes, the respective heating surfaces being 504, 739, 832 and 1,109 sq. ft., and are designed to operate with boilers working at pressures up to 650 lb./sq. in., and evaporative rating up to 10,000 lb./hr. The self-contained design of the units, which are completely insulated with end-casing and doors to enclose the circulating bends, makes them suitable for installation either indoors or out-of-doors, and the gas flow can be either upwards or downwards, without the need of modification. The accompanying graphical record is of performance data for a " Unicon " economiser of 24 tubes, 8 ft. long (four tubes wide by six tubes high) and two passes of gas, for both coal or oil-firing, covering evaporation rates ranging from 4,000 lb. to 10,000 lb./hr., and based on a boiler working pressure of 120 lb./sq. in., with no superheat. For coal-firing, the gases per pound of water are estimated at 2.5 lb., the corresponding figure for oil-firing being 1.8 lb., while respective feedwater temperatures are 120 deg. and 140 deg. F. From the respective curves it can be seen that with coal-firing, the saving of fuel at an evaporation rate of 4,000 lb./hr. is 16.4 per cent., with an inlet gas temperature of 600 deg. F., and 11.25 per cent. with an inlet gas temperature of 450 deg. F. (corresponding percentages with oil-firing at the same inlet gas temperatures being 13.25 per cent. and 8.8 per cent. respectively). At an evaporation rate of 10,000 lb./hr., the corresponding fuel savings are 12.75 and 9.8 per cent. with coal-firing, and 10.5 and 7.7 per cent. with oil-firing. Costly erection and



installation time is considerably reduced, as these " Unicon " economiser units are delivered to site completely cased and ready for fixing into position.

The Hon. A. F. Watts, Deputy Prime Minister of Western Australia, visited the Heaton Works, Newcastle, of **C. A. Parsons & Co. Ltd.** recently. He was received by **Mr. Gordon Baker,** managing director. During his tour of the works in the morning, he saw large turbo-generators of 500-MW and 300-MW capacity under construction. After lunch, Mr. Watts, accompanied by **Dr. A. T. Bowden,** director and chief research engineer, paid a visit to the company's nuclear research centre.

RECENT Equipment AND Accessories

Automatic shut-down valve

An automatic shut-down valve has recently been designed by I. V. Pressure Controllers Limited as a necessary safety device to operate wherever high-pressure pneumatics or hydraulics are used. It can be fitted into any system as a safeguard against injury to personnel, or damage to equipment, caused by a break in the system, or by a sudden pressure variation. The valve is used to shut-off the system whenever a minimum or maximum allowable pressure has been exceeded, or whenever there is a sudden pressure-variation. Pressure variations such as these are caused by pipe breakage, malfunctioning within the system, incorrect fitting to a fixing-point or careless disconnection. The valve, with its maximum working pressure of 4,000 lb./sq. in. (minimum 100 lb./sq. in.), is claimed to obviate this danger. Basically, it consists of a dome-like top chamber and a lower valve assembly. The dome is separated from the valve by a diaphragm which is sensitive to pressure-variation and is in direct contact with a poppet-head valve. Variation in pressure-differential across the diaphragm, pushes the poppet-head valve on to the valve seat, thus closing-off the passageway through the valve. Closing time is about 0.7 sec. The valve can be re-opened again by means of a small by-pass valve, built in the side of the body. The 3 in. diam. automatic shut-down valve weighing 1½ lb. closes instantaneously when subjected to sudden surges, but still allows large flows to pass through during the normal functioning of the system at temperatures ranging from 14 to 150 deg. F. (*I. V. Pressure Controllers Ltd., Atlas House, 893, London Road, Isleworth, Middx.*)

Six-in. diam. pinch-valves

W. H. Rowe & Son Ltd., electrical and mechanical engineers, recently announced the addition of a new 6-in. diam. pinch-valve to their range. The company's pinch-valves are designed to handle a wide range of substances including most powders, solids in suspension and liquids. Their most important feature is that they present a " straight through " bore at all stages of valve opening. Operation is by hand, lever, air-cylinder and diaphragm-motor, but initially the new 6-in. valve will be hand-operated only. The company also announced recently the introduction of Butyl sleeves for use with their pinch-valves. These new sleeves will greatly extend the use of pinch-valves in the chemical field, since Butyl is claimed to be the most resistant rubber to the more corrosive acids and chemicals. In addition, it can be used successfully with certain animal and vegetable fats, such as butter fat. A wide range of standard sleeves are available to suit food and liquids, including alcohol, acids, gases, petroleum and abrasive materials. (*W. H. Rowe & Son Ltd., Quayside Road, Bitterne Manor, Southampton.*)

Transistorised photo-electric equipment

The new " Series TPU.1 " range of transistorised photo-electric equipment (Fig. 1), which is available in alternative versions for counting or switching applications, is announced by Lancashire Dynamo Electronic Products Limited (a member of the Metal Industries Group). When used

Fig. 1. Transistorised photo-electric equipment. (Lancashire Dynamo Electronic Products Limited.)

for counting applications, the unit is supplied complete with a Series F.43 electromagnetic counter, which is energised directly from a transistor switch circuit. In this configuration, the unit is designed to operate at up to 1,500 counts/min. Six-figure indication gives a total of 999,999 counts, and manual-reset facilities are provided. In those applications where photo-electric switching is required, the unit is supplied with an integrally-mounted relay having one pair of normally-open and one pair of normally-closed contacts rated at 3 A, 230 V a.c. In this configuration, the unit is suitable for operation at switching rates up to 300/min. When used in conjunction with the standard 8-W remote-mounting light-source unit, both versions are suitable for operation over a range of 25 ft. The light-source unit obtains its supply directly from the photo-electric unit, and no additional supplies are required. The Series TPU.1 range of equipment is suitable for operation from 100/115 or 200/250 V, 50 c/s. supplies. (*Lancashire Dynamo Electronic Products Limited, Rugeley, Staffs.*)

A " biggest-ever " flexible coupling

Richard Thomas & Baldwins' new steelworks at Newport, Monmouthshire, will use the revolutionary L-D oxygen-blown steelmaking process which so substantially increases production. The great steel-converters will be electrically-tilted, the drive being engaged through very large internal gear flexible-couplings designed and manufactured by Crofts, the well-known Yorkshire firm of power transmission engineers. Three of these Crofts couplings are being supplied for the installation, each being some 73 in. in diameter, and weighing 11.8 tons ; and each is rated equivalent to 45,000 h.p. at 100 r.p.m. They are the largest ever made by Crofts—probably the largest of this type ever made, anywhere. The gear teeth are barrelled to accommodate considerable misalignment. [*Crofts (Engineers) Ltd., Bradford, 3.*]

New range of oil-burners

An extensive range of " Elco " oil-burners has recently been made available in this country by Corrie, MacColl & Son Ltd. (Elco Oil-burner Division), in association with the Swiss manufacturers. The high-precision Elco burners have been manufactured for more than 30 years, and are in use in more than 15 countries. Elco oil-burners operate on the pressure-jet principle, and are available in a range from 60,000 up to 7,000,000 B.Th.U./hr. Special industrial box-type burners which are capable of even higher outputs are also manufactured by the company. Elco oil-burners are capable of burning fuel-oils having viscosities ranging from 35 to 3,500 sec. Redwood No. 1 —100 deg. F. The standard types are available for on/off as well as high/low operation. The industrial box-type

burners are also for modulating operation with a turn-down ratio of 3 to 1. All Elco burners have photo-electric-cell flame-failure control, and every burner is fired and tested prior to dispatch. The outstanding feature of Elco burners is claimed to be their very quiet running, the heavy-oil models being particularly quiet. The smaller models are flange-mounted and therefore require no brick-base, while the larger units are supported by a die-cast foot and tubular-steel supports, which are adjustable to height on site. The larger burners are fitted with gravity-closed air control dampers so that the combustion chamber is not cooled by the introduction of cold air during shut-down periods. All Elco burners are said to be suitable for installations where it is desirable to place the oil tanks underground; the pumps produce a maximum vacuum of 24.26 in. Hg. (*Corrie, MacColl & Son Ltd., 500, Ipswich Road, Trading Estate, Slough, Bucks.*)

Quick-filling attachment for reducing valves

The time taken to fill a vessel with steam to a required pressure can now be reduced, it is claimed, by as much as 75 per cent. by using a new quick-filling attachment recently introduced by Sir W. H. Bailey & Co. Ltd. This time reduction is obviously important in, say, hospital sterilisation, but it can also mean increased production in various industrial processes, as the time taken for an operating cycle can be considerably reduced. The new, patented, quick-filling attachment (Fig. 2), which is designed for incorporation in a Bailey reducing-valve, obviates the delay inherent in the use of all conventional reducing-valves, by which the rate of pressure build-up decreases as the required setting is approached. The attachment allows full steam-flow through the valve to be maintained until the pressure is within 2 lb./sq. in. of the set pressure. At this stage, a special diaphragm control-valve lifts to admit steam to the underside of the diaphragm of the reducing valve, which then operates as usual. The attachment can be supplied as a conversion unit for existing Bailey Class "G3" reducing-valves, or already incorporated in new Class "G3" or Class "A" valves. (*Sir W. H. Bailey & Co. Ltd., Albion Works, Patricroft, Manchester.*)

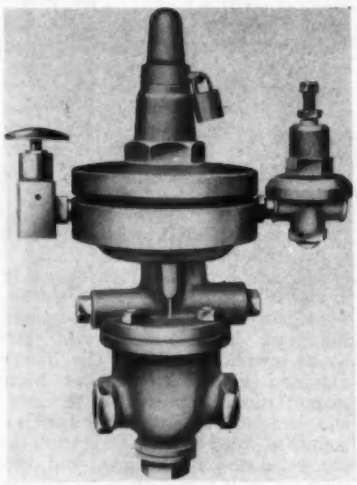


Fig. 2. Quick-filling attachment for reducing valves. (Sir W. H. Bailey & Co. Ltd.)

"Micro H" chemical feeder

Already widely used in America on applications involving chlorinating, defoaming, rust and scale inhibition, wash water detergents, cooling water treatment and slime control, the "FP Micro H" chemical feeder (Fig. 3) is now available in Britain from Fischer & Porter Limited, who are assembling it in their Workington factory. This chemical feeder is designed to feed, meter and regulate very low flow-rates of a chemical solution continuously into a liquid stream through its built-in ejector. By virtue of its plastics construction, the instrument, it is claimed, can be used with a very wide range of corrosive fluids. The reagent flow-rate is manually set and automatically regulated by an integral differential-pressure regulator. The "Micro H" chemical feeder is supplied with two 4 ft. lengths of plastic tubing fitted with adaptors for the supply and solution lines, and a 6 ft. length of plastic tubing fitted with a filter for the reagent suction line. (*Fischer & Porter Limited, Workington, Cumberland.*)

Fig. 3. "Micro H" chemical feeder. (Fischer & Porter Limited.)

Simplified calibration for new Rototherm thermometer

What is claimed to be the first British bi-metal thermometer, specially designed so that it can be re-calibrated without the need for a skilled technician, has been produced by the British Rototherm Co. Ltd. Named the "Zero Re-set," the thermometer (Fig. 4) was originally designed for installations in countries where there is a high proportion of unskilled labour, and where waiting for skilled men to re-set a thermometer can cause long delays. It is now anticipated that the instrument will be equally useful in this country on occasions when skilled labour is not readily available. The re-calibration procedure is said to be simple. At the lower back of the vertical head of the thermometer is a countersunk instrument screw stamped "RS—Re-set." After removing the screw, two turns of a 2 B.A. Allen key will loosen the locking screw and allow the thermometer stem to be rotated. This rotation moves the pointer and allows adjustments of up to 50 per cent. of the scale range to be made. A stop is incorporated in the locking device which makes it impossible to damage the instrument. The thermometer is at present available with 2½ in., 4 in. and 7 in. dials of the vertical pattern in all standard temperature ranges. Horizontal patterns of this thermometer will shortly be available. (*British Rototherm Co. Ltd., Merton Abbey, London, S.W.19.*)

Fig. 4. Simplified calibration for new Rototherm thermometer. (British Rototherm Co. Ltd.)

New pressure control switch

Expressly designed for the automatic control of pressure in a vessel—such as the control of an automatic stoker or oil-burner—is the pressure control switch, series 2 (Fig. 5), recently introduced by

Royles Limited. The mechanism comprises a diaphragm-operated micro-switch, with suitable spring-loaded leverage acting on the diaphragm to give the required operating pressure. The circuit can be arranged to give either "make" or "break" conditions on rising pressure, according to requirements. The whole of the mechanism is housed in a robust, black plastic box complete with cover. The pressure control switch is designed for operating pressures between 5 and 200 lb./sq. in., and a suitably calibrated spring is provided to cover the pressure range and differential required. Operating pressure is adjustable by means of a knurled knob on the top of the box; setting indication—within the range of the spring fitted—is given by the position of the pointer on the minimum/maximum scale. (*Royles Limited, Irlam, Manchester.*)

Fig. 5. New pressure control switch. (Royles Limited.)

Riley type "TT" chain-grate stoker

The recently-introduced Riley type "TT" stoker (Fig. 6) has been developed to burn small low-grade slack coal and is claimed to be suitable for installation in sectional boilers, rated at one million B.Th.U./hr. or more, used in central-heating applications. The complete unit is mounted on a frame wheel base, so that it can be wheeled into, and attached easily to, the boiler. Interlocked grate-links of heat-resisting cast-iron form an endless belt, and give uniform air distribution across the full width of the grate. The grate is driven from a front driving-shaft, carrying sprockets which engage in slots formed on the underside of the links. At the rear end, the grate rides over a plain idler-cylinder, revolving on a stationary shaft. The driving mechanism comprises a ½ h.p. geared motor unit driving into another gear train, and is carried at one end of the stoker front shaft. A spring-loaded dog-clutch, operating on a splined shaft, affords mechanical protection of the gearing and motor, provision being made for tensioning the grate. The mild-steel frame of the stoker is shaped to give a grate catenary, with a closing plate at the bottom, and a dead plate at the top extending beyond the coal register. The remainder of the effective length of the stoker is open for air passage, and is divided into three unequal zones with a designed pressure-drop, pro-rata at all pressures, to give a gradual reduction in air pressure from front to rear, so maintaining air escape to the combustion chamber at a minimum. Forced-draught is supplied to both sides of the stoker by a fan positioned below the machine. Automatic modulating control of the stoker feed and forced-draught volume is carried out by mechanically-coupling a timer unit to a Honeywell "Modutrol" motor which, in turn, is coupled to the forced-draught damper. A control thermostat sends impulses to the "Modutrol" motor per degree rise or fall away from its setting, and the motor accordingly adjusts the grate speed and the forced-draught volume in parallel with it, the grate speed being variable from approximately 13 to 1. A limit thermostat is fitted as a precautionary measure and, when called upon, it will stop the fan and stoker motors, only after the machine is at its minimum setting. Burning back into the hopper is, therefore, eliminated and when the control thermostat takes over again, the firebed will return to normal within one minute. [*Riley (IC) Products Limited, Nineteen, Woburn Place, London, W.C.1.*]

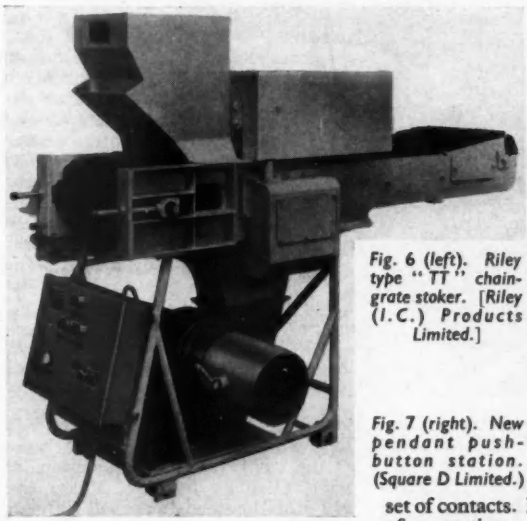


Fig. 6 (left). Riley type "TT" chain-grate stoker. [Riley (I.C.) Products Limited.]

New range of pendant push-button stations

Square D Limited have recently announced the availability of a new range of pendant-type pushbutton stations. This new range (Fig. 7), designated "Class 9001 Type TYB," is available in nine sizes, to accommodate any number of units from two to ten. Pendant stations are available completely assembled, or with cases and operators available separately. This marketing arrangement is said to give complete flexibility, since pendant stations can be assembled on site as required. The enclosures are of oil and dust-tight all-metal construction, and are designed to withstand the heavy usage imposed on pendant control stations. The oil and dust-tight features make these stations suitable for use in most types of industrial atmospheres. Any of the multifarious "Class 9001" pushbutton actuators manufactured by this company can be included in these pendant stations. Also available on these stations is a "wobble stick" actuator. This actuator offers additional personnel safety. Pushing the lever in any direction actuates a set of contacts. Because of this method of operation, the "wobble stick" actuator is particularly suited for use as an "emergency stop" on a pendant station where it is desirable to reach the operator quickly from any direction. All stations will be supplied suitable for the mounting of this actuator. (*Square D Limited, Cheney Manor, Swindon, Wilts.*)

Fig. 7 (right). New pendant push-button station. (Square D Limited.)

New oil-burner control

One policy of Photoelectronics (M.O.M.) Limited is to provide equipment for industry in its simplest form and complete with as many

associated controls as possible, "factory wired" to reduce site work to a minimum. Following this policy, the new oil-burner control "Type ABC/SS/TC" incorporates all the latest designs of the well-known sequencing and flame-failure control "Type ABC/SS," together with a Venner time clock "Type MD1QPS." These two units are mounted in one pressed-steel housing, 8 in. × 9½ in. × 4½ in., complete with hinged lid, and suitable for mounting either direct on the burner or on the boiler house wall. The time clock provides control for switching the burner on and off during any part of the day, and also, for selecting the days of the week during which the burner may not be required. Additional control arms can be provided to give further control of on and off periods during the day if required. The sequencing unit also operates on a synchronous motor. It provides the programming of the starting-up of the burner, controlling the ignition and oil motor, and is complete with photo-electric cell to guard against flame-failure. The unit is built around the safety features necessary for this type of installation, and conforms to the latest British Standard Specifications as well as L.C.C., Post Office and Ministry requirements. Plug-in sealed relays are provided to perform the control functions, and the contacts are capable of switching up to ½ h.p. motor single phase. An adjustable cam system is employed, providing simple yet accurate control of time periods, which are repetitively unchanged, regardless of ambient temperature changes or voltage variations. Using the photoresistive photo-cell, no amplifier is necessary, and no special cables are required. With this form of control, changes of sequence to suit a particular burner or site condition are claimed to be quickly and easily accomplished. The system is a simple switching action which, it is said, any installation engineer can master in a very short time. [*Photoelectronics (M.O.M.) Limited, Oldfields Trading Estate, Oldfields Road, Sutton, Surrey.*]

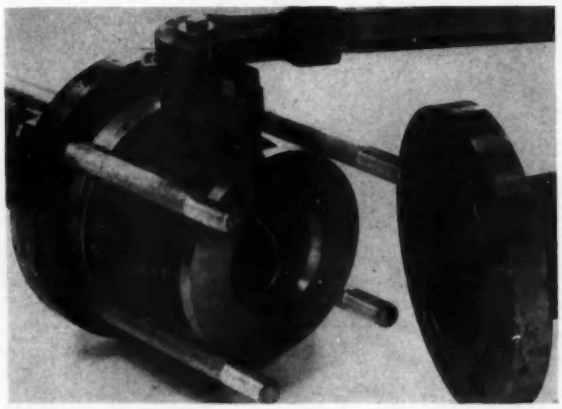


Fig. 8. New range of flanged ball-valves. (Worcester Valve Co. Ltd.)

Worcester Valve Company introduces flanged ball-valves

Minimum space requirements, easy handling, positive shut-off, fast operation and speedy maintenance are essential requirements in a flanged ball-valve. All of these qualities are claimed for the range of flanged ball-valves now being produced by the Worcester Valve Co. Ltd., to augment the ball-valve they successfully introduced into this country last October. Available in 3 in., 4 in., and 6 in. sizes, these flanged ball-valves (Fig. 8) provide one unit that will serve as either a 150 series (W.O.G.) or a 300 series (W.O.G.) valve where shorter than A.S.A. dimensions are advantageous. The centre section is simply and quickly inserted between two standard flanges, it is claimed (either 150 series or 300 series), and the flanges bolted together. Should either a 150 series or a 300 series A.S.A. dimension valve be required, the centre section can be modified by replacing the end-plate with an appropriate "spacer." The valve is also suitable for use with flanges to B.S. 10 standard. Because of the many various combinations of seats, O-rings (Buna-N, Nylon and P.T.F.E.) and body materials (bronze, carbon-steel, stainless-steel and aluminium, with other materials also available as specials), the Worcester ball-valve can handle almost any media within the pressure-temperature limitations of the sealing materials. (*Worcester Valve Co. Ltd., 62, Church Road, Burgess Hill, Sussex.*)

Mopump for general service

Rhodes, Brydon & Youatt Limited, makers of the well-known Mopump centrifugal pumps, recently announced the development of a range of very compact, close-coupled pumps, suitable for a large number of applications. As the name implies, the Mopump for general service (Fig. 9) is designed for a variety of applications and, to make this as wide as possible, the pumps are of all-ferrous construction. They are, therefore, suitable for filtration, air-conditioning, boosting, sump-drainage, water-softening, sprinkling, refrigeration, washing, condensate duties, mild chemical services, circulating systems and water services of many types. When initially considering this new Mopump, it was appreciated by the makers that space is very often at a premium. Consequently, much thought has been put into the design to provide the user with a pump of minimum size. The result is a most compact arrangement of pump and motor. The general service Mopump is of the single entry, single impeller type, and, since it is fitted with a mechanical seal, the shaft length has been reduced to a minimum. Hence the pump is more closely coupled to the motor than usual, and the whole unit is claimed to be extremely robust. The pump is designed to fit the new compact motors to the dimensions of British Standard 2960, Parts I and II, in which either drip-proof or totally-enclosed motors are interchangeable. The "G.S." Mopump is of all-ferrous construction; casing, seal housing and impeller are in cast-iron and the flanges are machined and drilled to B.S.T. "D." A capped nut and locking washer secure the impeller to the shaft on to which it is keyed, while the shaft is sealed by a spring-loaded radial-faced, balanced seal. Twenty-nine pump sizes, ranging from 1 in. to 5 in. branch size, provide a very comprehensive choice of pump and motor combinations. By fitting motors suitable for 50 c/s supply at both 2 pole and 4 pole speeds, a range of duties is available up to 500 gal./min. and total heads of 180 ft. (*Rhodes, Brydon & Youatt Limited, Reddish Engineering Works, Stockport, Cheshire.*)

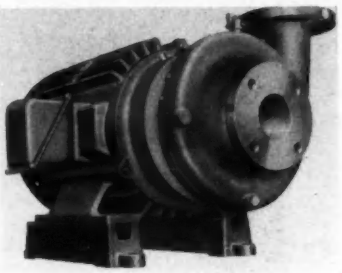


Fig. 9. Mopump for general service. (Rhodes, Brydon & Youatt Limited.)

Sealol welded bellows seal

Sealol Inc., one of the leading manufacturers in the U.S.A. of mechanical seals, have now established a company in this country for the manufacture and sale of their products, previously obtainable here under licence. The Sealol mechanical seal has a wide application for many industries, particularly by virtue of its ability to handle a wide range of

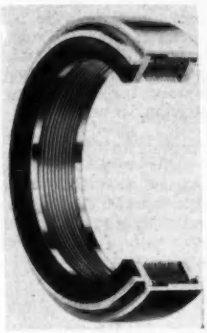


Fig. 10. Sealol welded bellows seal. (Sealol Limited.)

shaft-sealing problems, whilst retaining extreme light weight and compactness. It is hydraulically balanced and, therefore, it is claimed, can successfully handle fluids at very high pressures. Extreme ranges of temperature are also said to be satisfactorily dealt with by the careful selection of materials used in its construction. Typical applications range from simple uses, to the successful sealing of liquid gases, cryogenics and corrosive oils. Sealol Limited, the British company, is now introducing the latest version, a face-type seal (Fig. 10) incorporating a welded metallic bellows, which consists of a series of precision-made washer-like plates, welded to form convolutions. As each plate is individually die-formed, it is claimed that extremely accurate dimensional and performance tolerances are maintained. The plates can be of any weldable material, including stainless-steel, and the seal is thus suitable for handling liquids of a corrosive nature. The bellows seal, it is claimed, can withstand temperatures up to 1,500 deg. F., and pressures greater than 1,000 lb./sq. in. and, if necessary, seals to operate at pressures higher than 2,000 lb./sq. in. can be specially produced. The Sealol seal is used on power take-off shafts, fuel pumps (aircraft and rockets), oil refinery pumps, turbine-drive auxiliaries, charge machines and actuators (atomic energy reactors), hydraulic pumps and motors, vacuum pumps and jet engine main shafts. It is available in over 30 standard sizes with outside diameters ranging from approximately 1 in. to 5 in. to fit shafts ranging from ¼ in. to 4 in. dia. (*Sealol Limited, Willow Avenue, Uxbridge, Middlesex.*)

Controlling rate of corrosion

The Corrosometer, marketed in Great Britain and the Commonwealth by Winston Electronics Limited on behalf of the Crest Instrument Company, U.S.A., is said to create a new standard in the measurement of corrosion in the laboratory, process and storage plants in many industries, by giving a swift direct reading of the corrosion rate in less than a minute. By using this instrument and its probes the efficiency of anti-corrosion methods may be ascertained, and also remedial action may be carried out at the appropriate time, thus eliminating accidents, damage to plant and hold-ups. By means of its system of probes, the one instrument, which can be operated from mains, or battery, can measure the corrosion at a considerable number of points. The probes consist of an exposed specimen of the material of which the pipeline, reaction chamber, storage tank or laboratory sample is made, a reference specimen, and a check specimen. The reading from the probe is given directly in micro-inches or centimetres on the meter without removal of the specimen, and the Corrosometer may be used for all metals and alloys. Each reading is claimed to take less than 1 min. and to be independent of system temperature and of the environment. The probe is connected to the Corrosometer only at the time when the reading is made. The Corrosometer determines the progress of the corrosion on the metal specimen by measuring the increase in electrical resistance as the cross-section of specimen is reduced by corrosion. The probe is based on the fact that the electrical conductivity of metals is very great, while that of non-metals is negligible by comparison. The corrosive action on the exposed specimen converts the metal into a non-metal and thus the electrical resistance of the metal probe increases as the corrosion proceeds on its surface. The resistance ratio is then determined between the exposed specimen and a companion coated reference specimen made of the same metal. This method is the patented feature of the Corrosometer and gives readings which are independent of temperature. The measurement is made while the process is in full operation, because, once the probe is installed, it need not be removed, since, if the corrosion is carefully inhibited, the specimen will remain in place for months or even years. The Corrosometer itself may be installed in any convenient control room, since several hundred feet of extension cable may be used between the probes and the meter, or it may be used as a portable instrument for touring the plant or plants and taking readings regularly at probe points. (*Winston Electronics Limited, Shepperton, Middlesex.*)

New non-regeneratable demineraliser unit

The Permutit Co. Ltd., who design and manufacture "Deminrolit" water-demineralising equipment, have for many years been one of Britain's major producers of water treatment plant and ion-exchange materials. Since 1937, when Permutit made the world's first plant to produce pure water by ion-exchange, a whole range of equipment has been developed to deal with the vast quantities of pure water needed for large industrial users, and for the comparatively small quantities needed by laboratories and workshops. The latest unit in this range is the Mark 7 Portable "Deminrolit" unit (Fig. 11). This consists of a plastic body accommodating a battery-operated tester and control valves, plus a detachable plastic cartridge containing a bed of intimately mixed "Zeo-Karb" cation and "De-Acidite" anion-exchange materials. When water passes down through this column, virtually all ionised solids are removed, resulting in

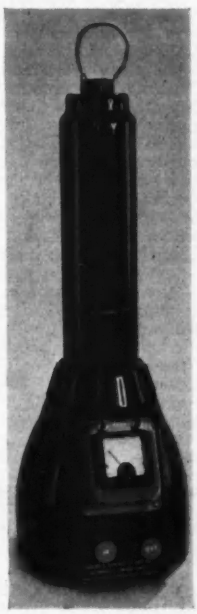


Fig. 11. Non-regeneratable demineraliser unit. (The Permutit Co. Ltd.)

demineralised water of a quality satisfying the B.P. specification for purified water. After treating its rated capacity, the cartridge is replaced by a regenerated one and further treatment can then continue. Permutit have a speedy cartridge-exchange system to ensure continuity of supply, and the low cost of this equipment is expected to appeal especially to the user of small quantities of pure water. On water of London type, the Mark 7 "Demin-

rolit" will produce about 16 gallons of purified water per cartridge—and much more on moorland water common in Northern England. Added to this there is the undoubted advantage of the ion-exchange process: no scale or sludge, simplicity in operation, constant flow rates, and purified water of consistent quality—monitored continuously by the tester. The introduction of the Mark 7 Portable "Deminrolit" unit in no way affects the availability of the larger Portable "Deminrolit" units, which operate on similar principles but are equipped for regeneration on the spot. (*The Permutit Co. Ltd., London, W.4.*)

Mr. W. M. Warren, M.B.E., M.I.Mech.E., M.I.E.E., chief generation engineer, C.E.G.B. East Midlands Division, who has just retired, has been concerned with the operation of thermal power station plant for more than 40 years. Prior to nationalisation of the electricity supply industry, Mr. Warren was Deputy Borough Electrical Engineer at Derby. He joined the East Midlands Division on its formation in 1948, and for 10 years was generation engineer, Northern Group. He became chief generation engineer for the whole Division in 1958.

* * *

Mr. A. D. Thomson, B.Sc., has been appointed deputy managing director of Edwin Danks & Co. (Oldbury) Ltd. Mr. Thomson joined Babcock & Wilcox Limited as a student apprentice in 1946. Following a period of technical training at Paisley Technical College, he graduated in 1949 with an external degree of B.Sc. (Hons.) in mechanical engineering from London University. From 1954/1956 he was assistant to the manager of the Calorizing Corporation of Great Britain Limited, a subsidiary of Babcock & Wilcox, and was later transferred to the Special Vessels Department of the parent company, working in close liaison with Edwin Danks & Co. (Oldbury) Ltd. Since 1958, Mr. Thomson has been Head of the Atomic Energy Commercial Section of Babcock & Wilcox, being responsible for tendering on nuclear work, and for the financial control of nuclear contracts.

* * *

A contract has been awarded to the Heating and Ventilating Division of **Sulzer Bros. (London) Limited,** for the mechanical services at the new Stevenage factory of Bowater Packaging Limited. These services include air-conditioning for the laboratory, heating and ventilating for the office and amenities buildings and, for the factory, a Sulzer radiant-strip system served by high-pressure hot water. The factory will manufacture corrugated fibre-board packaging products. The architects for this 340,000 sq. ft. project are Farmer and Dark F./F.R.I.B.A.

* * *

Associated Electrical Industries Limited, has received an order from Australia for 220-kV switchgear for the Hazelwood Power Station of the State Electricity Commission, Victoria. The total value of the order placed with Associated Electrical Industries Pty. Ltd., in Australia is £A636,000 and is for the supply and erection on site of a complete switch yard. A great deal of the equipment will be manufactured in Australia by AEI, but part of it, valued at approximately £230,000, will be made in Britain in the factories of the company's Switchgear Division. AEI is already supplying two 200-MW turbine-generators and three 255-MVA generator transformers for the Hazelwood Station.

Lodge-Cottrell Limited have been instructed by the Foster Wheeler-John Brown Land Boiler Consortium, on behalf of the Central Electricity Generating Board, to proceed with the supply of precipitators for four 350-MW boilers at Tilbury "B" Power Station. The contract value is approximately £1,100,000. The flue-dust produced by these four pulverised-fuel-fired boiler units will be partially removed by mechanical collectors, and final cleaning will be carried out by 12 electro-precipitators—three to each boiler unit. Each precipitator will be of the three-stage, horizontal gas - flow, high - efficiency design, with the necessary high tension transformer/rectifier equipment. Each group of three precipitators will handle 990,000 cu. ft./min. of gas (continuous maximum rating) at 257 deg. F. with a guaranteed collecting efficiency of 99.3 per cent.

* * *

As part of their continued policy of expansion in the export market **Flexibox Limited,** Manchester, manufacturers of mechanical seals for pumps, compressors, mixers and other rotary equipment, and precision lapping machines, have announced the formation of two new subsidiaries in Italy and Australia. This follows the formation in April of a subsidiary in Holland—Flexibox N.V. The new Italian company—Flexibox S.p.A.—commenced operations on July 1st. It has been formed jointly by Flexibox Limited and their present Italian agents—Tecnologie Industriali. In Australia, the new subsidiary will be known as Flexibox Pty. Ltd. and is owned jointly by Flexibox Limited and Harland Engineering (Australia) Pty. Ltd., Footscray West, Victoria. The Flexibox group of companies already includes Flexibox S.A. in Paris and Flexibox G.m.b.H. in Frankfurt in addition to the parent company—Flexibox Limited—in Manchester.

* * *

The Cambridge indicating pneumatic temperature controller, described in the new List 103 issued by **Cambridge Instrument Co. Ltd.,** is an instrument for controlling the working temperatures of vats, autoclaves, or other similar containers; and the temperatures of refrigerating, air-conditioning, or other similar plants and processes, between −20 deg. C. and +340 deg. C. (−10 deg. F. and +650 deg. F.). When the temperature of the container or process rises or falls beyond a predetermined level, the controller automatically cuts off the piped supplies of heating or cooling fluid or gas until the temperature returns to the pre-set level. The controlled temperature can either be that of the process or container itself, or less frequently, that of the piped supplies. The instrument can be used in almost any industrial process where the flow of heating or cooling medium can be regulated by a diaphragm valve.

The Hulett Group of Companies have placed an order with **W. H. Allen Sons & Co. Ltd.,** Bedford, for a condensing turbo-alternator which will provide for one of their sugar factories on the Triangle Sugar Estate, Rhodesia. With a power output of 3,000-kW, the plant will comprise an Allen steam turbine running at 6,000 r.p.m. driving through Allen-Stoeckicht epicyclic speed-reduction gearing, a Mather & Platt totally-enclosed water-cooled alternator at 1,500 r.p.m. The turbine is designed to operate with steam at a pressure of 435 lb./sq. in., and 606 deg. F., exhausting to a separate basement condenser with a vacuum of 27.5 in. of mercury, and the turbo-alternator will run in parallel with other generating plant at site, the power supply being 6.6-kV, 3 phase, 50 c/s at 0.8 power factor.

* * *

A new Division of Associated Electrical Industries Limited has been formed to manage the company's Home District Offices. **Mr. V. S. Risoe,** M.B.E., B.Sc., M.I.E.E., has been appointed general manager of the new Division, and takes up full-time duty on August 1st, 1961. After nearly 20 years service with the company in India, Mr. Risoe returned to England in December, 1956, when he was appointed to the board of Associated Electrical Industries Overseas Limited. In 1959, he joined the Board of the First Electric Corporation of South Africa Limited. Mr. Risoe resigned from both these Boards on August 1st.

* * *

After 41 years at the one address (56, Victoria Street), the London office of **C. A. Parsons & Co. Ltd.,** Newcastle upon Tyne, has been transferred to a new suite of offices at 40, Broadway, Westminster, S.W.1. In addition to the offices, which house the executive, administrative and clerical staffs, provision is being made for an increased sales and outside maintenance staff. The new building, of which Parsons will take the ground floor, is ideally central. It is close to St. James' Park Underground Station and within a few hundred yards of their old offices.

* * *

Mr. C. M. Vignoles, who until recently was managing director of Shell-Mex and B.P. Limited, has been appointed chairman of Evershed & Vignoles Limited, in succession to **Mr. J. C. Needham** who recently retired from the board.

* * *

Henry Simon (Holdings) Limited announce that **Mr. F. J. Sullivan** has been appointed a director of Turbine Gears Limited. He was previously commercial manager of Turbine Gears Limited.

* * *

Mr. John Hayward has been appointed public relations officer of the General Electric Company Limited.

OVERSEAS Steam Engineering Practice

Abridgments of recent articles in the colonial and foreign technical press, concerning design and progress in the technique of steam generation and power plant equipment

Ash removal problem solved

Removal of ash is an important step in the generation of steam, and especially so in an installation as large as that at the Eastlake plant of the Cleveland Electric Illuminating Co., where some 400 tons of ash accumulate daily. Pits must be cleaned frequently and thoroughly, and with a minimum of labour, to ensure continued efficient and economical operation of the boilers. Ash must be removed every eight hours, and this is done by flushing with water. There is an accumulation of about 15 tons at each flushing. Water is pumped directly from Lake Erie, through a $\frac{3}{8}$ in. mesh screen, without cleaning or processing of any kind. It therefore contains a large amount of sand and other coarse material which is carried through the flushing system. A secondary, but equally serious problem, is the shock of the water hammer due to pressure built up suddenly when the valve is closed. This closing action has proved costly, in lost production time, maintenance time, and the frequent replacement of broken valves, since the original valve was unable to withstand the water hammer, the pressure of which sometimes reached as high as 900 lb./sq. in. Republic Manufacturing Company was called in to develop a new design that would solve these problems, which it did with a three-way, 3 in. rubber-faced plug with 300 lb./sq. in. flanges made of a high-tensile, semi-steel castings, keyed to a steel stem or shaft. This design has now compiled enough experience to indicate its soundness. (*Combustion*, Vol. 32, No. 12, June, 1961, p. 41.)

Paper Mill Expansion in India

The Star Paper Mills at Saharanpur, Uttar Pradesh, began manufacturing pulp and paper some 23 years ago from Sabai grass grown in the lower hilly regions of the Himalayas. In 1955, the daily output of paper had reached 45 tons due to remodelling and plant improvement. At this time an expansion scheme was started and new equipment ordered, including two new paper machines, both of which are now in service. The raw material, which was selected after exhaustive tests had been carried out, was twisted pine from the lower Himalaya regions. This material has no other commercial use and this is the first time it has been used in India for paper production. To meet the increase in power demanded by the new plant, Crompton Parkinson Limited have supplied two 2,000 kVA and two 1,500 kVA transformers as well as a large number of electric motors. The original mill draws its power from a 2.5 MVA turbo-alternator installed on the site, whereas the total power required by the new plant is approximately 8 MVA and arrangements have been made with the Uttar Pradesh State Electricity Board for the mill to receive additional power from the grid. Distribution is at 11 kV, stepped down to 420 V at four main load centres, and provision has been made to enable either the old or the new mill to be supplied from either grid or alternator, although it is understood that parallel operation is not intended. Of the 280 Crompton Parkinson motors for the new mill, totalling some 5,300 h.p., those above 50 h.p. were supplied from the Guiseley works in England and the balance from the rotating plant factory at Worli, near Bombay. The large motors, of 250 and 225 h.p., are of the drip-proof slip-ring type, driving Hydrafiners, Jordans and Carthage Chippers. All these machines operate in the moist atmosphere of the mill which is considerably aggravated by the extremes of ambient temperature experienced in Saharanpur, ranging from 45 to 115 deg. F. in summer.

Power development in Nigeria

We notice from the ninth annual report of the Electricity Corporation of Nigeria, which was published recently and covered the year ended March 31st, 1960, that further progress in load development is recorded. The Corporation's chairman, Professor Eni Njoku, reports that both light and heavy industries of different types are being established at the major load centres. The policy of encouragement and assistance in the industrial and commercial development of the country, by applying special terms to large consumers with favourable load characteristics, continued throughout the period under review. Progress was recorded in the Corporation's new towns development programme, and the installation of pilot village schemes was continued. The two village schemes of Bichi in the Northern Region and Omoba in the Eastern Region were completed, and the new undertaking of Owerri was commissioned in March, 1960. An increase of 19.3 per cent. was reported in kWh generated, which rose to 361 million, while sales to consumers went up by 18 per cent. to 287 million kWh. New generating plant with a capacity of 35.3-MW was installed during the year, bringing the total generating capacity now in commission up to 135.7-MW. During the nine years since vesting day, both the installed generating capacity and the aggregate maximum demand have increased about seven times. An increase of 21.4 per cent. in revenue was reported bringing the total for the year to £4.7 million and there was a net surplus of £442,095 compared with £427,177 in the previous year. Attention is drawn to the fact that increasing surplus is enabling the Corporation to finance more of its capital programme out of revenue and so relieving the Federal Government of an appreciable part of the burden on its resources.

Air-lifted nuclear power plant in transit

The first nuclear power plant for the American Air Force, prefabricated into 16 packages, was transported 1,700 miles by air in early June, to a Wyoming mountain top. The plant, incorporating a pressurised water reactor, was built for the Air Force by the Atomic Energy Commission under a joint programme of the Commission and the Corps of Engineers. The Martin Company, Baltimore, was the main contractor for the plant, designated PM-1 (Portable

Medium Plant No. 1). The reactor is scheduled to achieve criticality (sustained chain-reaction) in September. It will be cooled and moderated by light water and will be fuelled with highly enriched uranium. When operational in 1962, it will provide 1,000-kW of electrical power and 2,000-kW of heat for the 731st Radar Squadron of the Air Defence Command, 29th Air Division, Semi-automatic Ground Environment (SAGE). The plant will provide engineering and operating data for the design of improved nuclear power plants which can be used at Air Force installations. The PM-1 was designed to provide for factory-assembled modules or packages, both for air transportability and for quick assembly, so that nuclear power can be made available anywhere in the world where Air Force units may be needed. The package design also allows the plant to be dis-assembled and re-located. The largest packages are 8 ft. 8 in. × 8 ft. 8 in. × 30 in. and weigh less than 15 tons each. The Commission will install and test-operate the plant for six months before transferring it to the Air Defence Command for operation. Co-ordination of the development programme for the PM-1, within the Air Force, has been the responsibility of the Air Force Systems Command's Electronics Systems Division at Hanscom Field, Bedford, Massachusetts, and the AFSC's Special Weapons Centre at Kirtland Air Force Base, Albuquerque, New Mexico. The Special Weapons Centre will supply engineering support to the Air Defence Command. The operating crew for the PM-1 includes 17 airmen under the supervision of an Air Force officer. All crew members have received extensive nuclear power plant operating and maintenance training, and experience in AEC-Department of Defence nuclear power training programmes, and are certified nuclear plant operators. The crew has been augmented by two qualified servicemen one from the Army and one from the Navy. The crew has accumulated a total of over 80 years of reactor operating experience. (*Combustion*, Vol. 32, No. 12, June, 1961, p. 31.)

Fuel and Power Trends in Australia

The outlook for coal in Queensland and New South Wales continues favourable, in spite of increasing competition from oil. The export picture is one of closer association with markets in Japan, particularly that country's steel industry. According to a statement by the Japanese Iron and Steel Federation, the industry hopes to rely more heavily in the future upon Australia for supplies of coking coal. Out of a total of 24,500,000 tons of this coal to be brought from abroad to Japan in 1970, the U.S.A. and Australia are expected to supply 50 per cent. and 22.9 per cent. respectively, compared with 77.8 and 10.4 per cent. at present. The Mitsui group, one of Japan's largest industrial organisations, wishes to co-operate with the Australian company Thiess Holdings Ltd. in the development of the Kianga coalfield, Central Queensland. Several shipments of soft coking coal have been exported to Japan from the Kianga open-cut. The Japanese steel mills are, however, anxious to obtain supplies of hard coking coal and it appears that the deposit at Moura, eight miles north of Kianga, is of a suitable type. The first shipment from this source left the port of Gladstone recently, and for the next four years 500,000 tons will be exported annually to Japan under an order valued at £A8m., received from Mitsui. Legislation is to be introduced into the State Parliament giving Messrs. Thiess an absolute franchise over the deposits of coking coal in the Kianga field. In return, the Thiess organisation will build a 100-mile railway line at a cost of £A8m. between Kianga and Gladstone, subject to the provision of Government aid through the resumption of land. Denationalisation of the State Coke Works at Bowen and the State Coal Mine at Collinsville is envisaged in an announcement by the Minister for Mines, Mr. E. Evans, that tenders are to be called for the sale of the two properties, which since 1957 have been operated at a heavy loss.

New South Wales

The State's coal output in the year ended June 30th, 1961, reached the record figure of more than 18m. tons. This was 10 per cent. more than in 1959-60. Exports were up by 1,655,000 tons, being more than double the figure for the previous year. The greatest increase in production was in the Southern District of the State. In the Northern Coalfield, production will be increased further in the next few years to meet the requirements of the new power stations planned by the State Electricity Commission. That being constructed at Vales Point, at the southern end of Lake Macquarie, near Newcastle, will be the largest Electricity Commission power station in New South Wales. It will be supplied with coal from three large new collieries—Chain Valley (J. and A. Brown and Abermain Seaham Collieries Ltd.), Newvale (N.S.W. Electricity Commission), and Wyee (State Mines Control Authority). From these collieries there will be direct delivery of coal to the power station by conveyor belts. The Electricity Commission has selected a site for a new 700-MW generation station at the northern end of Tuggerah Lakes, south of Newcastle. The station will be located between Lake Munmorah and Lake Budgewoi, close to natural cooling water and to proven coal reserves, both on an adequate scale. The Joint Coal Board's estimate of the coal reserves in the neighbourhood of the site is 150 m. tons. The deposit is entirely owned and controlled by the Crown. Work on the site will begin late this year or early in 1962. In Australia, not only does the electricity supply industry use more coal, both brown and bituminous, than any other industry, but it has the greatest rate of increase in coal consumption. The demand for electricity doubles every ten years, and it is supplied mainly from thermal stations, the hydro-power contribution being only about seven per cent. It is estimated that by 1980 New South Wales consumption will have increased from the present figure of 4 million tons to 8 million tons of bituminous coal. The trend in coal production in the Northern Coalfield of New South Wales continues to be towards concentration in larger units, with a greater degree of mechanisation. Between June 1954, and July 1960, the number of mines operating in this field decreased from 97 to 57, and in the same period, colliery proprietors spent about £A16m. on mine mechanisation and development, representing 43 per cent. of the total expenditure by the N.S.W. coal industry in the period. The result was a rise in the output per manshift from 3 to about 6 tons. Statistics released by the Joint Coal Board show that in the year ending December 1960, Australian output of black coal, at 22,500,000 tons, was 11.1 per cent. up on the figure for 1959. N.S.W. figures were up by 12.9 per cent., Queensland up by 2.6 per cent., Victoria down by 6 per cent., South Australia up by 24.5 per cent.,

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Oil and chemicals from coal

The leader of the Country Party of Victoria, Sir Herbert Hyland, has urged the Victorian State Government to undertake production of liquid fuel from Gippsland's brown coal, as a defence measure and an investment in future safety. Competent authorities, he said, considered that it should be possible for the Gas and Fuel Corporation of Victoria to produce enough oil and petrol at its Lurgi gas plant to keep the State's agriculture going in the event of overseas supplies being cut off. Development of by-products from brown coal should be the Government's immediate aim.

Turbo-Alternators for Australia

W. H. Allen, Sons & Co. Ltd., have recently received two contracts from Australia for turbo-alternator plant, the total value of the contracts being approximately £83,000. The first contract, received from Kodak (Australasia) Pty. Ltd., is for a 1,200-kW self-contained double pass-out condensing turbo-alternator set comprising an Allen steam turbine running at 6,000 r.p.m., and driving a Lancashire Dynamo & Crypto alternator at 1,500 r.p.m. through a top pinion parallel-shaft speed-reduction gear-box. Steam will be supplied to the turbine at a pressure of 430 lb./sq. in. and 735 deg. F.—up to 23,700 lb./hr. being available at 160 lb./sq. in. pass-out pressure for running on existing 500-kW Allen pass-out condensing set. A proportion of the steam (up to 6,000 lb./hr.) will be used to meet process demands at 35 lb./sq. in. through an automatic pressure-reducing valve. A second pass-out will provide up to 19,800 lb./hr. of steam at 10 lb./sq. in. for process and space-heating requirements. The turbine will be designed to produce the maximum rated output of 1,200-kW under a variety of pass-out flow conditions, as well as under conditions of full flow to the condenser (at a vacuum of 28.0 in. of mercury). An interesting feature of the installation is that very little foundation material will be required, since a self-contained arrangement is to be adopted in which the turbine will be mounted upon a special condenser forming part of the sub-base for the machine.

A second Australian order has been received from Union Carbide (Australia) Limited (Chemical Division), Sydney, for one 1,400-kW back-pressure turbo-alternator set, together with associated equipment including a transformer, rectifier and switchgear. The machine will be designed to operate with steam at up to 640 lb./sq. in. and 720 deg. F., exhausting up to 50,000 lb./hr. to process at 155 lb./sq. in. The speed of the Allen turbine will be 11,000 r.p.m., and it will drive a Mather & Platt 1,400-kW alternator at 1,500 r.p.m. through an Allen-Stoeckicht epicyclic speed-reduction gear-box. The plant is to generate a.c. power to meet the works load in parallel with the Sydney County Council supply, and variable voltage d.c. power for the production of chlorine by electrolysis in soda-chlorine cells. The exhaust process steam is to be used for various chemical product manufacture.

* * *

Richardsons Westgarth & Co. Ltd. have received an order from the Government of Curacao for two vacuum flash evaporators, each capable of producing 1,400,000 gal./day of drinking water. The order, which is worth approximately £500,000, is scheduled to be delivered in less than 12 months.

Associated Electrical Industries Limited has received an order from West Germany for a Metroflux Type "T" Universal Magnetic Crack Detector. This equipment designed by AEI Instrumentation Division to detect surface cracks and flaws in magnetic materials uses the principal that in such materials a magnetic field will be distorted in the neighbourhood of a fault. The Type "T" unit, which is to be supplied to Klackner Humboldt Deutz, of Cologne, is designed for testing, on a production basis, gas-turbine aero engine discs up to 42 in. diameter with or without blading, and shafts up to 6 in. diameter and 84 in. long. A combination of a.c. and d.c. methods of magnetisation and multiple adjustable pole pieces enables all types of surface cracks to be revealed, whatever their direction.

* * *

An order has now been placed by Steel Peech & Tozer (Branch of the United Steel Companies Limited) with the gas-cleaning division of **W. C. Holmes & Co. Ltd.** to supply gas-cleaning plant for each of the first two 110-ton oxygen lanced electric arc furnaces to be installed at Templeborough Works. Each gas-cleaning installation consists of a direct fume-extraction system, an electrical precipitator and a common water-treatment plant. Completion of the first installation is scheduled for October 1st, 1962, and the second for February 1st, 1963.

* * *

Geigy (Holdings) Limited announce that **Viscount Rochdale,** who is a member of their Board, has succeeded **Mr. A. H. Whitaker** as chairman of their subsidiary company, James Anderson & Co. (Colours) Ltd. **Dr. F. Buchmeier** has been appointed deputy-chairman of that company.

* * *

Lodge-Cottrell Limited announce that they will be supplying Dorman Long Limited with a further five precipitators for the Lackenby Steel Plant oxygen-blown open-hearth steel furnaces. This, therefore, makes a total of six furnaces to be supplied with precipitators at a contract value of approximately £440,000. Plant for each furnace will consist of one four-stage horizontal-flow high-efficiency electrofilter, together with all the necessary transformer rectifier equipment, ventilation fan, drag-link conveyors, rotary seals, and dust-collecting and pelletising plant.

* * *

Rhodes, Brydon & Youatt Limited, manufacturers of centrifugal pumps, under the trade mark MOPUMP, have appointed **Mr. M. J. B. Hodgson,** B.Sc., A.M.I.Mech.E., as area manager for the Midlands at their offices in Griffin House, Ludgate Hill, Birmingham 3, (Telephone: Central 8911).

C. A. Parsons & Co. Ltd., Heaton Works, Newcastle upon Tyne, has signed a licence agreement with Zallea Brothers, Delaware, U.S.A., for the manufacture and sale of thinwall-bellows expansion joints of Zallea design. The agreement provides for the marketing of the British-made products in the United Kingdom, the European Free Trade Area, and British Commonwealth (with the exception of Canada). Zallea Brothers have made these expansion joints in the U.S.A. for over 25 years, and today are the world's largest manufacturers in this field. Zallea expansion joints are used to absorb movement in a wide range of piping applications particularly in the oil and chemical industries. Both axial and lateral movements are accommodated with any pressure between vacuum and 1,000 lb./sq. in., and temperatures in the range minus 320 deg. F. to 1,600 deg. F. Parsons are now able to accept enquiries for expansion joints, suitable for nominal bores of 3 in. to 48 in. for delivery after mid-1962.

* * *

Mr. R. S. Phillips has joined the Instrumentation Division of Evershed & Vignoles Limited as chief of development, dealing with electronic process control equipment. Mr. Phillips, who has been in the electronics industry for 20 years, was previously with Epsylon Industries Limited where he was engaged in the development of process controls in relation to textile manufacture.

* * *

Belliss & Morcom Limited, Birmingham, have been awarded the contract for a 12,750-kW turbine and condensing plant, by the Ministry of Works, for the National Gas Turbine Establishment, Pyestock. The turbine will be a straight condensing set, arranged to drive an existing alternator which has hitherto been driven by a gas-turbine. This makes an unusual installation because it means that the set must be arranged to utilise the existing foundations and services which were not designed for this type of turbine. This is by no means the first installation of this type undertaken by Belliss and Morcom Limited. When completed in 1962, the set will be used to supply power for the testing facilities at this important research establishment.

* * *

Brook Motors Limited, Empress Works, Huddersfield, have issued an informative 16-page booklet (list 929), for the electric motor user. It gives valuable help in obtaining the correct type of motor for specific purposes. Constructional variations, covering the needs of normal, dust-laden, or even explosive atmospheres, are covered, and a section on electrical modifications gives useful data on reversing, multi-speed and intermittent rating characteristics.

Accrington Corporation Garage and Workshops—the Stores, Offices and Staff Rooms, are heated by one Redfyre Emma boiler producing 1,500,000 B.Th.U./hr.

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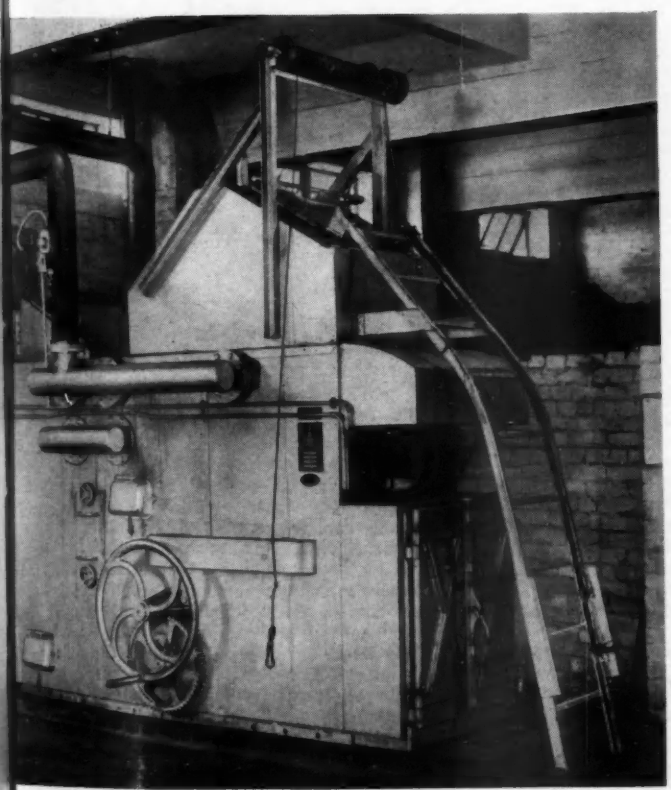

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Latest Power Plant Patents

These extracts from British Patent Specifications are reproduced by permission of The Controller of H.M. Stationery Office. (Complete British Specifications can be obtained from the Patent Office, 26, Southampton Buildings, London, W.C.2. Price 3s. 6d. each, both inland and abroad.)

Conversion of excess energy from nuclear power

In nuclear power plant installations, economic problems arise from the fact that such plants, in view of their high initial cost and low cost of operation, should, if possible, operate day and night, while, on the other hand, the load curves of the power stations on the public supply grid show very large fluctuations between day and night loads. Therefore, it has been proposed to store the excess energy, which during the night cannot be directly disposed of in hydraulic pumping plants, and recover the same during the day. Such plants are costly however; they can be erected only on suitable sites where adequate cooling water supplies are readily available. Thus expensive transformers and long distance transmission lines are necessary. The efficiency, taking into account the transmission losses, is approximately 70 per cent. Since nuclear power plants will generally be placed as near as possible to the large consumer centres, it would be natural to connect an excess-energy storing-system directly with the power station. This can most easily be done, as far as steam-turbine plants are concerned, by heat storage. The invention shows a new way for increasing considerably the efficiency of heat storage, and of bringing the same, theoretically, even up to a full 100 per cent. for both steam and gas-turbine plants. According to the invention, there is provided a method for the thermodynamic storage of excess energy from a nuclear power station, having a cooling system, wherein the excess energy is used to remove heat from the cooling system, and to pass it at a higher temperature to an accumulator where the stored energy is regained by making use of the temperature difference between the accumulator and the ambient temperature. Referring to Fig. 1, from the reactor (1) hot gases, e.g. nitrogen emerge, and expand in the gas-turbine (2), are cooled in the heat-exchanger (3), heating the gases coming from the compressor (4^1 and 4^2), and return to the reactor. The two coolers (5^1 and 5^2) remove heat (waste heat) for the reduction of the gas compression work, by means of cooling water, which comes from the environment, and is represented by a container (6). This waste heat is supplied in the form of hot water to the top of the low-pressure accumulator (10). During the excess energy period—which is the charging period of the high-pressure accumulator—the water content is passed through the expansion vessels (11^1 and 11^2), shown to be in two stages, from where the compressor (12) driven by a generator (16) acting as a motor, energised from the generator (7), draws the aspirated steam, and forces it into the high-pressure accumulator (with or without cooling), where it condenses, heating the accumulator.

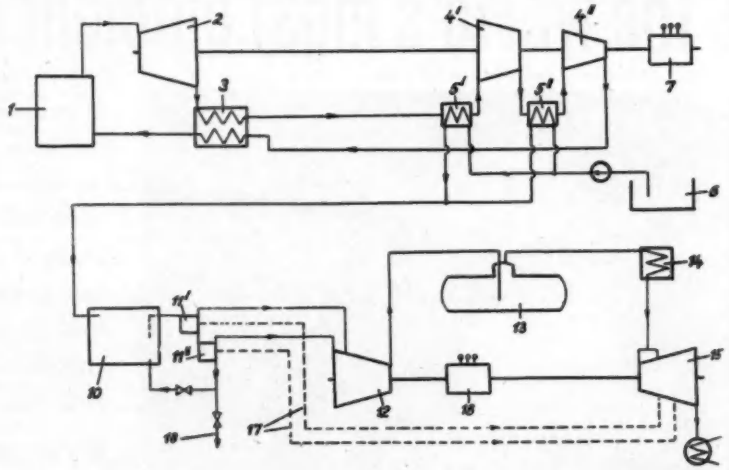


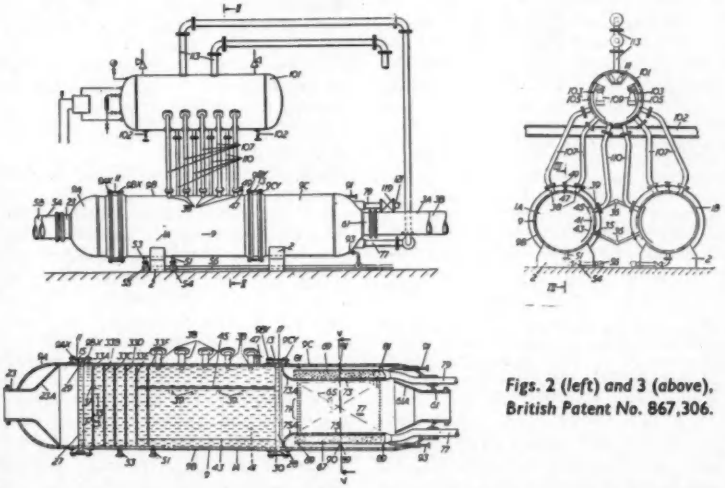
Fig. 1. British Patent No. 866,939.

During the discharge period, steam flows from the high-pressure accumulator (13), if desired through the superheater (14) (or a superheat recuperator which obviously must be connected in a slightly different manner) into the turbine (15) which drives the generator (motor) (16). During the discharging period the lines (17) pass steam from the low-pressure accumulator (10) to lower stages of the turbine, as far as permissible. During the charging period (excess energy period) the cooled water from the expansion vessel may be recycled to the accumulator from below, according to the displacement principle, if desired. During the discharging period, however, it flows off, as indicated (at 18). Since, during the discharging period, waste heat is still being derived from the gas-turbine, while the low-pressure accumulator may contain cooler water than the cooling water coming from the gas-turbine plant, the low-pressure accumulator may be conveniently subdivided to obviate mixing. The same applies when the temperature of the cooling water is increased during the excess energy period. *British Patent No. 866,939 issued to F. Marguerre. Complete specification published May 3rd, 1961.*

Steam-generating heat-exchanger

This invention relates to steam-generating heat-exchangers and, more particularly, to boilers for nuclear plants, and nuclear power plants incorporating such boilers. In known nuclear power plants of the kind having a reactor, with a core utilising a solid moderator, and arranged to be gas-cooled, the boilers have been in the form of vertical elongated cylindrical pressure-vessels affording passages for coolant under pressure, and containing economiser, steam-generating and superheating heat-exchange surfaces, comprising tube lengths, extending transversely to the passages. In order to ensure adequate circulation through the sinuous tubes constituting the steam-generating

sections, circulating pumps have been used. In a nuclear reactor power plant, reduction in the power consumed by circulating fans and pumps, or any provision whereby the output of the plant may be increased, or its capital cost reduced, is highly desirable and of great importance. Moreover, in mobile power plants, such as for ship propulsion, compactness and lightness are matters of importance, and the use of vertical elongated cylindrical pressure-vessels for the boilers is inconvenient. In order to obtain a heat-exchanger, which is light and compact, for a given heat-exchange duty, it is important to obtain a good coefficient of heat transfer from the coolant gas to the metal wall separating the gas from the working medium of the boiler, and secondly, from the metal wall to the working medium. Where the working medium is in the form of water or steam, a relatively high velocity of flow of the working medium over the metal wall is necessary. On the other hand, when the working medium is undergoing vaporisation, the boiling film coefficient of heat transfer at the metal wall is substantially independent of velocity of flow of water over the metal wall. Since the power needed to maintain a flow of water or steam over the metal wall increases considerably with its velocity, it is possible to economise in power by careful selection of the flow velocity over the metal wall in different parts of the boiler. The steam boiler shown in Figs. 2 and 3 is adapted for operation with a ship-borne nuclear reactor of the gas-cooled, graphite-moderated type in which the gaseous coolant is carbon dioxide at a substantial pressure, of the order of 300 lb./sq. in. A coolant circulating-fan (not shown) drives the coolant through a closed circuit including two parallel-connected heat-exchanger units (1A and 1B), each supported on two spaced cradles (2). Gas passes to these two units, respectively through supply ducts (3A and 3B), and is withdrawn from them, respectively, through exhaust ducts (5A and 5B). The two units (1A and 1B) are similar to one another. During operation of the plant, the carbon-dioxide gaseous coolant is driven round the closed coolant circuit by the circulating fan, and the nuclear reactor is then rendered critical. Heat developed in the core of the nuclear reactor is absorbed by the coolant gas, and the heated coolant heats and vaporises water and superheats steam in the units (1A and 1B). In these units, the heated coolant first passes transversely over the superheater tubes (71), then passes through the tubes in the pressure vessel section (9B). Water is fed continuously through the feedwater inlet nozzles of both of the units (1A and 1B). In one unit (1A), for example, the feedwater passes from nozzles (35) through the pipes (37) into the space between the tube plate (27) and the baffle (33A), in which space it passes horizontally across the parts of the tubes which lie in that space, turning to pass round the baffle edge (33AX) and then returning horizontally across the parts of the tubes which lie in the space between the baffles (33A and 33B). This to-and-fro flow across the tubes is continued as the feedwater passes between the baffles (33B, 33C, 33D, 33E and 33F) until the feedwater escapes into the steam-generating section of the boiler unit, namely, that part which lies between the baffle (33F) and the tube plate (28). In the steam-generating section, water passes upwardly through the spaces between the tubes, absorbing heat and forming and entraining bubbles of steam. The steam water mixture so formed, passes out through the nozzles (38) and flows upwardly through the pipes (107) into the associated pocket (105) in the drum (101). From the pocket (105) the steamwater mixture flows into the cyclone separators (109), from which the water is discharged downwards into a lower part of the drum, and the steam is discharged upwards into an upper steam space of the drum (101). The water collected in the lower part of the drum (101) flows downwards through downcomer tubes (110) into the space (41) in the unit (1A), flows downwardly through that space into the lower part of the pressure vessel, and then joins the feedwater in flowing upwards over the steam-generating parts of the tubes in the section (9B). The steam flows from the steam space of the drum (101) through the scrubber (111) into the steam conduits (113), and thus, to the lower inlet superheater headers (such as header 67). The steam flows from the header (67), through the superheater tubes (71) to the upper outlet header (69), and thence through a steam pipe (79) to the steam main. The water and steam flows in the unit (1B) are similar to the flows described above with reference to the other unit (1A), and steam from the second unit (1B) joins steam from the first unit (1A) in the steam main. *British Patent No.* 867,306 *issued to Babcock & Wilcox Limited. Complete specification published May 3rd,* 1961.

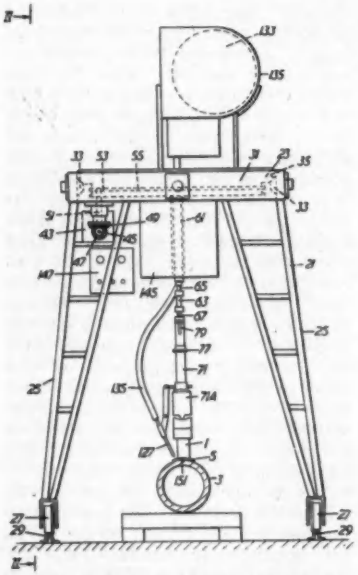


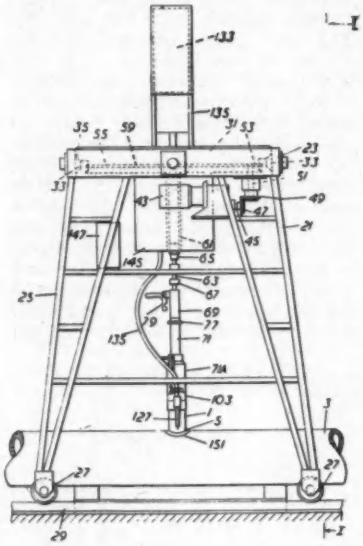
Figs. 2 (left) and 3 (above), British Patent No. 867,306.

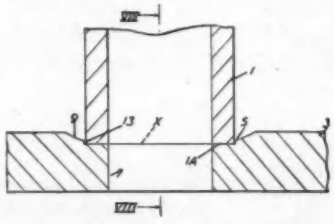
Welding metal stubs to curved surfaces

This invention relates to the welding of metal stubs to curved surfaces. One application of the invention is the welding of incompletely bored-out tube stubs to steam boiler wall-boxes of round cross-section, and requiring the addition of many such tubes to the boxes. The accepted procedure consists of welding the incompletely bored-out tube stubs to the wall-box, stress relieving the completed box, effecting hydraulic testing of the box, and then boring-out the tube stubs. The desired tube lengths are then welded to the tube stubs. The invention includes a welding machine, suitable for arc welding a metal stub to a curved surface. There are positioning means for locating an electrode holder in relation to the stub, so that the electrode holder may be rotated about the stub while in the

proper welding position. Means are provided for rotating the electrode holder about the stub, and there is a cam having a profile representative of the junction between the surfaces to be joined. By this means the tip of the electrode carried by the holder







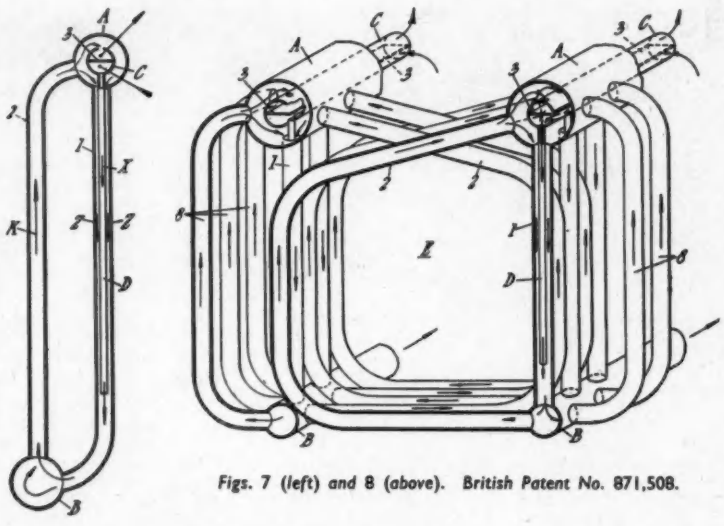
Figs. 4 (*above*), 5 (*above, right*) and 6 (*right*). *British Patent No.* 871,459.

is held in the appropriate position and distance from the joint to be made during rotation of the electrode. Fig. 4 shows the side elevation of the welding machine, as viewed in the direction indicated by the arrows at I-I in Fig. 5, and Fig. 5 is a front elevation of the machine shown in Fig. 4, as viewed in the direction indicated by arrows at II-II in Fig. 4. In the case illustrated, the problem is to weld a large number of closely-spaced mild-steel nozzles (such as the stub or nozzle 1), each having a wall thickness of $\frac{1}{2}$ in. and having an outside diameter of 3 in., to a mild-steel cylindrical box (3) of circular cross-section having a wall thickness of 1 in. and an outside diameter of 12 in. It will be appreciated that in such a case, the finished weld (5) between a nozzle and the box is curved in three dimensions. The stub or nozzle (1) is in the form of a short length of tube, similar to the tube which will later be welded to its free end, the only preparation required being that the end (1A) of the nozzle, which will engage the box (3) is ground or machined flat and square to the axis of the nozzle. If desired the stub or nozzle (1) may be only partially bored, a medial wall being left, so as to facilitate hydraulic testing of the completed pressure-vessel. As shown in Fig. 6 the box (3) is prepared at the point where the stub is to be secured by the boring of a hole (7), the diameter of which is equal to the interior diameter of the nozzle, and by the machining of the box to form a part-cylindrical surface (9) having an axis which extends transversely to the box, followed by the radial boring of a shallow recess (13) having a flat bottom and coaxial with the hole already formed in the box; the diameter of this recess is slightly larger than the outside diameter of the nozzle. The depth of this recess (13) is such that the flat surface so formed is level with, or just below, the bottom of the part-cylindrical surface (9) at the transverse centreline of the hole in the box, relevant considerations being the relative diameters of the stub (1) and the box (3) and the wall thickness of the box. The stub (1) is then placed with its flat end (1A) in contact with the flat bottom of the radially bored recess (13), the stub then extending radially to the box (3) and being located in proper position by the metal shoulders along the longitudinal limits of the recess in the box. The welding machine (21) is in the form of a stand, having an overhead support member (23) of rectangular shape, provided with braced tubular legs (25) at its corners. Each leg is provided at its lower end with a flanged wheel (27). One of these wheels is provided with a spring-loaded brake which can be manually held in the "off" position when it is desired to move the stand. The box (3) is arranged between rails (29) upon which the wheels (27) can run, with its longitudinal axis parallel to the rails. *British Patent No. 871,459 issued to Babcock & Wilcox Limited. Complete specification published June 28th, 1961.*

Boiler for providing hot and superheated water

This invention relates to boilers, particularly for providing hot and superheated water. In Fig. 7 there is an upper collector (A) of tubular shape. To this are connected a downcomer (1) and a boiler tube (2), both of which are also connected to a lower collector (B). There will be two rows of tubes (1 and 2) arranged perpendicularly to the plane of the drawing, these tubes being either in contact with each other, or at a convenient distance from each other. Inside the upper collector (A) a water conduit (C) is axially located, its outer diameter being substantially smaller than the inner diameter of the collector (A). The water conduit (C) brings in the cold water returning from the utilising apparatus. To the conduit (C) are connected the truncated tubes (D), each being coaxially placed inside a downcomer (1) and being shorter than the latter. The cold water from the conduit (C) flows into the tubes (D) in the direction of the arrow X and is preheated by the action of the warmer water, which flows down, in the direction of the arrows Z, along the interspaces between the tubes (D and 1), the inner diameter of the tube (1) being substantially larger than the outside diameter of the other tube (D). The cold water, therefore, cannot come into contact with the tube (1) which is exposed to the furnace, thus preventing the formation of corrosive deposit. Also, the water circulation in the desired direction will be activated by way of the dragging action of the water flowing from the free end of the truncated tube (D) upon the surrounding water. In the area of the free end of the truncated tube (D), the two liquid streams mix together, thus forming a single stream, which, in its course along the tube (2), in the direction of the arrow K, will be heated, and on reaching the upper collector (A) will divide into

two parts, the first one being taken away to the utilising apparatus, while the second will resume its circulation through the interspaces existing between the tubes (1 and D). In Fig. 8 a furnace (E) is formed by two rows of tubes in contact with each other along a generatrix, which are connected to the upper collector (A) and to the lower collector (B). The downcomers (1) and the boiler tubes (2) alternate with each other, their function being determined by the presence of the truncated tubes (D), which exist only inside the downcomers. The tubes (D) are connected to the conduit (C) bringing in the cold water, which is placed inside the upper collector (A). The hot water is delivered to the utilising apparatus through a nozzle (6) of the collector (A). Through the collector (B) the water from the downcomers goes to the boiler tubes (2), as shown by the arrows. This passage can take place partly among tubes placed on the same side with respect to the furnace, and partly among tubes placed on opposite sides. It is, of course, understood that two distinct lower collectors, placed, for instance, laterally, may also exist, in which case the lower part of the furnace will not be limited by the tubes. In such a case the circulation within the lower collectors will be obviously limited to the downcomers and the boiler tubes which belong to the same side. *British Patent No.* 871,508 *issued to G. Rossi. Complete specification published June* 28*th*, 1961.



Figs. 7 (*left*) *and* 8 (*above*). *British Patent No.* 871,508.

In keeping with its policy of maintaining the highest standards of reliability and efficiency in the turbo-generators for which the company is famous, **C. A. Parsons & Co. Ltd.** have, for more than half a century, been well aware of the need for research and development at the very highest levels. Following the commissioning of the laboratories at the Nuclear Research Centre at Heaton, just over two years ago, the company has just completed the construction and equipping of a new Mechanical Research Laboratory designed to ensure that the company's interests in the rapidly changing requirements in the power industry are fully backed up with the most up-to-date experimental facilities. Some of the equipment is of a kind which will serve not only Parsons interests, but which will meet a national need; contracts have already been made in this direction. The opening ceremony on June 14th was marked by **Mr. J. L. Gray,** B.Sc., A.M.I.Mech.E., Turbine Plant Design Engineer of the Central Electricity Generating Board setting "Bess" to work. "Bess" is a very modern experimental steam turbine designed particularly to investigate the performance of low-pressure blading, and which, in common with other test turbines at Parsons, has been named after a member of the family of Sir Charles Parsons.

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Mr. B. C. Pyle, M.I.E.E., formerly assistant chief project engineer, Northern Project Group, has been appointed to succeed **Mr. W. B. Shannon,** formerly assistant chief project engineer, Southern Project Group. Mr. Pyle joined the Portsmouth Electricity Service in 1936, as a student engineer, where he remained until 1939, when he was appointed as a junior technical assistant by the Sheffield Corporation Electricity Department. From 1946 until 1948, he served as a technical assistant with the Portsmouth Electricity Service; then he joined the Southern Division as personal assistant to the divisional controller. In 1953 he was appointed a generation engineer, and in 1956 was promoted to chief generation engineer, Southern Division. He was appointed assistant chief project engineer to the Northern Project Group in 1958, the post he has now vacated. **Mr. D. A. Pask,** V.R.D., A.C.G.I., B.Sc.(Hons.), A.M.I.E.E., A.M.I.Mech.E., formerly project engineer, Southern Project Group, has succeeded Mr. Pyle at the Northern Project Group. Mr. Pask joined the South Western Division in the Generation Construction Department in 1948, working at Newton Abbot power station, and later at Plymouth "B" power station as acting resident engineer. In 1951, he was stationed at East Yelland power station as resident engineer, remaining until 1954, when he was seconded to U.K.A.E.A. at Calder Hall as deputy resident mechanical and electrical engineer, and later deputy resident engineer. He was transferred to Headquarters in 1957 as principal assistant engineer in the Nuclear Power Sub-department, and in 1957 became projects engineer in the same department. In 1958 he joined the Southern Project Group as a project engineer, the post he has now vacated.

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Mr. David H. Bramley has been appointed production director of Geo. Salter & Co. Ltd., the West Bromwich spring balance and spring manufacturers, in succession to **Mr. P. P. C. Drabble** who retired at the end of July.

National Coal Board Films

Among a group of colour films recently produced by the National Coal Board is one entitled "Mechanical Firing of Coal." This film, which comprises six separate sections, has a total running time of about 60 min. Primarily designed for showing to managers of industrial undertakings and their engineers, and to other branches of industry generally, this film includes an introduction which deals with coal production and handling, it shows four different types of mechanical stoker. The group can either be shown as a whole, or the appropriate section dealing with one of the types of mechanical stoker. Any section can be sandwiched between the introductory section and the tail piece, or one or more of the sections showing mechanical stokers can be shown individually. The actual types of stokers featured are—the chain-grate, coking, underfeed and gravity-feed stokers respectively.

* * *

Over the past few weeks, contracts to the value of nearly £250,000 have been received by **Cochran & Co. (Annan) Ltd.,** for the supply of various types of industrial and marine boilers. This is a direct result of the company's vigorous export drive in Europe, Africa and Asia. It is interesting to note that many of the contracts are for the firm's recently-introduced Packaged Boilers, which have made a great impact overseas, particularly with hospital and factory engineers who have steam-raising problems. Commenting on the improved sales overseas, **Mr. J. S. B. Lea,** the managing director, said that "Although our sales position is certainly encouraging, even bigger efforts are now being made to enter markets which have hitherto been untouched by Cochrans."

NOTES Personal AND Industrial

Lt.-General Sir William Stratton, K.C.B., C.V.O., C.B.E., D.S.O. (who was vice-chief of the Imperial General Staff, 1957-1960), has been appointed chairman of Edwin Danks & Co. (Oldbury) Ltd., and of Penman & Co. Ltd., in succession to the late **General Sir Kenneth Crawford.** Both these companies are members of the Babcock & Wilcox Group.

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The National Coal Board have appointed **Mr. C. W. Moss** as assistant director-general of their Process Development Department. He is at present a deputy-director of the Board's Central Engineering Establishment at Bretby in Derbyshire. The Process Development Department was formed in April, 1951, under **Dr. J. Bronowski,** to further the development of new processes for treating coal and in particular for bringing new process for making smokeless briquettes from small coal to the stage of commercial production.

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Mr. A. M. Browne, president of the British Electrical and Allied Manufacturers' Association, presented a transistor radio set on behalf of the BEAMA to **Sir Josiah Eccles** to mark his service to the electrical industry, which he has served with distinction for nearly 40 years. Sir Josiah retired from the Electricity Council at the end of July. The presentation was made at the recently-held BEAMA Council Luncheon at the Connaught Rooms, London.

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Mr. T. Carlile, B.Sc.(Eng.), A.C.G.I., has been appointed general manager of Renfrew, Dalmuir and Dumbarton works of Babcock and Wilcox Limited on the retirement of **Mr. D. D. Cruickshank,** C.B.E., from that position. Mr. Carlile joined Babcock & Wilcox Limited in 1944 and was appointed to the Project Department. In 1948 he was transferred to the New York Office of the company, and two years later, in 1950, he became the company's New York representative in the United States. In January, 1954, he returned to Great Britain to take up the appointment of assistant general manager of Renfrew and Dumbarton works, and in July, 1959, he was appointed deputy general manager of the company's Scottish works in Renfrew, Dalmuir and Dumbarton.

* * *

A new illustrated brochure describing their range of mobile constant potential X-ray units has been produced by **Pantak Limited,** Vale Road, Windsor, Berks. These machines make use of a double Greinacher circuit using metal rectifiers to supply a rectified constant potential voltage to the X-ray tube. Compared with vacuum glass valve rectifiers, metal rectifiers have considerably greater stability and life, resulting in lower replacement costs and longer stabilised X-ray tube performance.

After 48 years' service with the General Electric Co. Ltd., **Mr. A. B. Price,** B.Sc., A.M.I.Mech.E., sales manager at the company's Engineering Works at Erith, retired recently. After 27 years' service in Cardiff as branch manager for South Wales and south west England, Mr. Price returned to Erith in 1949 to become manager of the Turbine Department, and a few years later was appointed sales manager at the Erith works, the post he held at his retirement.

* * *

The welding business of **English Electric Co. Ltd.** has been co-ordinated in a newly-formed Welding Equipment Division at the company's Accrington works (telephone Accrington 33241). The manager of the division is **Mr. R. H. Boughton,** the chief engineer **Mr. F. Mullery,** and the sales manager will be **Mr. E. H. Ayres.**

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Mr. E. H. Boyce, A.M.I.E.E., A.M.I.Mech.E., etc., deputy superintendent of Northfleet Power Station, has been appointed station superintendent of Richborough Power Station. Before coming to Northfleet in 1959, Mr. Boyce was station superintendent of Kirkstall and Whitehall Road Stations, Leeds.

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Dr. James Burns, G.M., deputy-chairman, North Thames Gas Board, has been elected president of the **Institute of Fuel,** and will take office in October, 1961.

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Mr. Justin H. Scott, B.A., has been appointed to the Board of Laurence, Scott & Electromotors Limited, thus renewing the active participation of the Scott family in the management of the firm founded by his grandfather in 1883. His father, whose untimely death occurred in 1942, was then managing director. Mr. J. H. Scott joined the company about 10 years ago at the Norwich Works, where he has already held executive positions.

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Mr. D. B. Flook, who has lately been with Thos. Ward Limited, has joined Webb Conveyors and Automation Limited, a member of the Elliott-Automation Group, as principal sales engineer for the south of England.

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Mr. J. L. Thompson, general manager and director of Square D Limited, has been appointed managing director. Mr. Thompson has been general manager of the company since its inception in November, 1955. He was appointed director in 1958.

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Mr. C. H. G. Hayward, general manager of the Combustion Division and **Mr. H. Harding Smith,** general sales manager, Edwin Danks & Co. (Oldbury) Ltd., have been appointed directors on the Board of that company.

The **National Council for Technological Awards** announces that the address of the Council is now 24, Park Crescent, London, W.1, telephone Langham 4897.

* * *

The Heavy Plant Division of **Associated Electrical Industries Limited** has established a Service Department, with headquarters in Rugby, to co-ordinate after-sales service for all its products. The manager of this department is **Mr. B. M. Swift,** M.I.E.E., who joined B.T.H. at Rugby in 1929 as an engineering apprentice. Later he joined the Industrial Sales Department as a special applications engineer, and immediately after the war moved to the London District Office for two years before returning to Rugby to take charge of the Service Section of Industrial Sales Department, now Industrial Machines Department of the A.E.I. Motor and Control Gear Division.

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The Coal Preparation and Mining Division of **Simon-Carves Limited** is being transferred to Carlisle, and after December 31st, 1961, their address will be: Simon-Carves Limited, P.O. Box No. 26, Durranhill, Carlisle. This move is being undertaken to concentrate in one place, the activities of Simon Engineering in coal-preparation and mining work. **The Automatic Coal Cleaning Co. Ltd.,** Carlisle, already operate from this Carlisle address, and the integration and closer co-operation should prove of great benefit to clients. Simon-Carves Limited and the Automatic Coal Cleaning Co. Ltd. will each offer in the future, the same range of designs and services as they have in the past.

* * *

Rhodes, Brydon & Youatt Limited, Stockport, Cheshire, announce that the address of their London offices has been changed from 76, Victoria Street, S.W.1, to 45/51, Leman Street, London, E.1 (telephone ROYal 1212).

* * *

Vokes Limited have recently issued a leaflet concerning the Autoroll Mk. II automatic air filter, which has been produced at lower cost than their original Autoroll, due to increased demand, simplification in design, new economies in manufacture, etc. The filter is available in three standard forms, normal flow, reverse flow and the "Manuroll" hand-operated unit. The filter medium is a fire-resistant fibrous mat, carded to an even density, and fused at the intersections. The Mark II Autoroll is manufactured in a range of sizes, the frames being of fabricated construction.

* * *

E. Green & Son Limited, Wakefield, have been appointed sole licensees in the United Kingdom for the manufacture of Sinter Fans and Schicht Axial Blowers designed by **Kuhnle, Kopp & Kausch,** Frankenthal.